Chapter 6
Operations: Affected Environment and Project Impacts

6.0 Introduction

For the purposes of this Draft Environmental Impact Statement (Draft EIS), environmental resource areas have been divided into three categories: the Built Environment, the Natural Environment, and Operations (Chapters 4, 5, and 6, respectively). The purpose of this chapter is to discuss the operations resource areas assessed for the Millennium Bulk Terminals—Longview project (proposed export terminal).

Information contained in this Draft EIS was drawn from environmental technical reports located in Volume III of this Draft EIS and incorporated by reference. The technical reports include more detailed discussions on methods used for analysis, the affected environment, and potential impacts of the proposed export terminal.

6.0.1 Operations Resource Areas

Chapter 6, *Operations: Affected Environment and Project Impacts*, evaluates the operational resource areas relevant to the proposed export terminal. The resource areas in this analysis include rail transportation, rail safety, vehicle transportation, vessel transportation, noise and vibration, air quality, coal dust, and greenhouse gas emissions (Table 6.0-1). Additional detailed information about these resources can also be found in the corresponding technical reports in Volume III of this Draft EIS.

Chapter 8, *Minimization and Mitigation*, presents measures to mitigate potential impacts of the proposed export terminal identified in this chapter.

Table 6.0-1. Operations Resource Areas and Corresponding Draft EIS Sections

Chapter	Section Number	Environmental Resource Area
Chapter 6, Operations: Affected Environment and Project Impacts	6.1	Rail Transportation
	6.2	Rail Safety
	6.3	Vehicle Transportation
	6.4	Vessel Transportation
	6.5	Noise and Vibration
	6.6	Air Quality
	6.7	Coal Dust
	6.8	Greenhouse Gas Emissions

6.0.2 Alternatives and Timeframe for Analysis

This chapter analyzes impacts that would likely occur as a result of construction and operation of the proposed export terminal. The analysis assumes construction beginning in 2018 and full operations[1] occurring by 2028.

This chapter also refers to project-related rail and vessel traffic during construction and operations. Table 6.0-2 illustrates the project-related rail and vessel traffic for the peak year of construction and full operations evaluated in this chapter, and the rail and vessel activity for the two stages between the peak year of construction and full operations. Throughout this chapter, the location of the proposed export terminal for both the On-Site Alternative and Off-Site Alternative is referred to as the *project area*.

This chapter also analyzes impacts that could occur under the No-Action Alternative. Chapter 3, *Alternatives*, of this Draft EIS provides a description of the On-Site Alternative, Off-Site Alternative, and No-Action Alternative.

Table 6.0-2. Project-Related Rail and Vessel Activity by Construction and Operation Stage[a]

	Peak Year of Construction (2018)	Stage 1a Startup Operations	Stage 1b Increased Operations	Full Operations (by 2028)
Proposed Export Terminal Throughput (million metric tons of coal per year)	0	10	25	44
Rail Traffic				
Average total train trips per day	1.30[b]	4	10	16
Vessel Traffic				
Average vessels per month	63 barges[c]	15[d]	40[d]	70[d]

Notes:
[a] For additional information on the stages, see Chapter 3, Section 3.4.3, *Proposed Facilities, Construction, and Operations*.
[b] If construction materials are delivered by rail to the project area for the On-Site Alternative and Off-Site Alternative, as described in Chapter 3, *Alternatives*.
[c] If construction materials are delivered by barge and transported via truck to the project area for the On-Site Alternative and Off-Site Alternative, as described in Chapter 3, *Alternatives*.
[d] Approximately 80% Panamax-class and 20% Handymax-class vessels.

[1] Full operation means an export terminal throughput of up to 44 million metric tons of coal per year, as described in Chapter 3, *Alternatives*.

6.0.3 Study Areas and Type of Impacts Analyzed

As discussed in Chapter 1, *Introduction*, the NEPA scope of analysis includes the activities requiring a Department of the Army permit from the Corps, plus those activities outside the permit area over which the Corps has sufficient control and responsibility. Therefore, the Corps' scope of analysis for this Draft EIS includes the project area, the area that would be dredged, any dredged material disposal sites, any off-site area that might be used for compensatory mitigation, and any other area in or adjacent to the Columbia River that would be affected by, and integral to, the proposed export terminal.

Within the overall NEPA scope of analysis, study areas have been defined for each resource. The size and location of each study area depends, in part, on the physical and/or biological characteristics of the resource, logistics, nature and extent of potential impacts, and how the resource is regulated. Separate study areas are normally identified for direct impacts and indirect impacts. Table 6.0-3 explains the general differences between direct and indirect impact study areas.

Table 6.0-3. Types of Impacts and Impact Examples

Type of Impact	Description	Example of Impacts
Direct	An impact resulting from either construction or operation of the proposed export terminal at either the On-Site Alternative or Off-Site Alternative location. Direct impacts are caused by the action and occur at the same time and place (40 CFR 1508.8).	• **Construction:** Temporary impacts within the project area that are resolved or mitigated by the end of construction, or permanent changes to the project areas due to construction of the proposed export terminal. • **Operations:** Impacts occurring in the project area resulting from rail unloading, coal storage, machinery operations, equipment, vessel loading, etc.
Indirect	An impact resulting from construction or operation of the proposed export terminal that occurs outside the project area or later in time. Indirect impacts are caused by the action and are later in time or farther removed in distance, but are still reasonably foreseeable (40 CFR 1508.8).	• **Construction:** Impacts that occur outside the project area, such as vehicle and rail traffic that support construction activities • **Operations:** Impacts from activities that occur outside the project area, such as rail, vehicle and vessel traffic that support operational activities, or that occur within the project area later in time

Table 6.0-4 provides a summary of the direct impacts and indirect impacts study areas for operations resources. These study areas were developed based on the U.S. Army Corps of Engineers' Memorandum for Record (MFR) entitled *Scope of Analysis and Extent of Impact Evaluation for National Environmental Policy Act Environmental Impact Statement*, dated February 14, 2014. The study areas contained in this Draft EIS typically conform with the MFR. In some cases, study areas were adjusted were adjusted to reflect the characteristics and specific elements for each resource area.

Table 6.0-4. Summary of Direct Impacts and Indirect Impacts Study Areas by Resource

Resource	Direct Impacts Study Area	Indirect Impacts Study Area
Section 6.1, Rail Transportation	Project area for the On-Site Alternative and Off-Site Alternative	Project areas and Reynolds Lead and BNSF Spur rail corridor
Section 6.2, Rail Safety	Project area for the On-Site Alternative and Off-Site Alternative	Project areas and Reynolds Lead and BNSF Spur rail corridor
Section 6.3, Vehicle Transportation	Project area for the On-Site Alternative and Off-Site Alternative	Arterials and secondary roads in the vicinity of the Longview industrial area along the Columbia River, which includes public and private at-grade crossings on the Reynolds Lead and BNSF Spur
Section 6.4, Vessel Transportation	Area surrounding the proposed docks where vessel maneuvering and loading would occur	Waterways to be used by or affected by vessels calling at the project areas, which includes the lower Columbia River from the mouth of the river to Vancouver, Washington,[2] and the Willamette River upriver to the Port of Portland
Section 6.5, Noise and Vibration	Area within 1 mile of the project areas for the On-Site Alternative and Off-Site Alternative	Direct impacts study area plus the area within 1 mile of the BNSF Spur and Reynolds Lead
Section 6.6, Air Quality	Approximate 5-mile radius around the project areas for the On-Site Alternative and Off-Site Alternative	Approximate 20-mile radius from the project areas
Section 6.7, Coal Dust	Project area for the On-Site Alternative and Off-Site Alternative and area beyond the project areas potentially affected by terminal operations	Project areas and the areas within 1,000 feet of the Reynolds Lead and BNSF Spur
Section 6.8, Greenhouse Gas Emissions	Project areas and in the vicinity of the project areas that could be affected by greenhouse gases resulting from construction and operation of the proposed export terminal, and the lower Columbia River from the project area to the mouth of the river	Same as direct impacts (direct and indirect impacts were not differentiated for the analysis)

[2] For purposes of this EIS, the lower Columbia River ends at the landward limit of the Territorial Sea, which is a line drawn between the seaward tips of the North Jetty and South Jetty. The Port of Vancouver is the furthest upriver port receiving large commercial vessels.

6.1 Rail Transportation

Railroads provide transportation for passengers and a wide range of commercial goods, and support regional economic activity. Similar to other forms of transportation, rail traffic is subject to various regulatory requirements, including requirements for tracks, rail cars and locomotives, crew, operations, inspection and maintenance, tariffs, and methods and types of goods and services that can be transported.

This section assesses the potential rail transportation impacts of the proposed export terminal. For this assessment, rail transportation refers to unit trains[1] servicing the proposed export terminal (project-related trains), as well as the type and volume of other rail traffic using the same rail lines. At full operations, the export terminal would bring approximately 8 incoming unit trains[2] carrying coal, and send out approximately 8 empty unit trains each day. No rail construction outside of the project areas for the On-Site Alternative or Off-Site Alternative is proposed by the Applicant.

This section describes the regulatory setting, presents the historical and current rail transportation conditions in the study area, establishes the methods for assessing potential rail transportation impacts, and assesses potential impacts.

6.1.1 Regulatory Setting

Laws and regulations relevant to rail transportation are summarized in Table 6.1-1.

Table 6.1-1. Regulations, Statutes, and Guidelines for Rail Transportation

Regulation, Statute, Guideline	Description
Federal	
Federal Railroad Safety Act of 1970	Gives FRA rulemaking authority over all areas of rail line safety. FRA has designated state and local law enforcement agencies have jurisdiction over most aspects of highway/rail grade crossings, including warning devices and traffic law enforcement.
Highway Safety Act and the Federal Railroad Safety Act	Gives FHWA and FRA regulatory jurisdiction over safety at federal highway/rail grade crossings.
Federal Railroad Administration general regulations (49 CFR Parts 200–299)	Establishes railroad regulations, including safety requirements related to tracks, operations, and cars.
Interstate Commerce Commission Termination Act of 1995 (49 USC 101)	Establishes the Surface Transportation Board and upholds the common carrier obligations of railroads; requires railroads to provide service upon reasonable request.

[1] A unit train is a train in which all cars carry the same commodity and are shipped from the same origin to the same destination.

[2] A "train" is defined in this section as a one-way train trip.

Regulation, Statute, Guideline	Description
State	
Washington Utilities and Transportation Commission	Inspects and issues violations for hazardous materials, tracks, signal and train control, and rail operations. WUTC regulates the construction, closure, or modification of public railroad crossings. In addition, WUTC inspects and issues defect notices if a crossing does not meet minimum standards.
WSDOT Local Agency Guidelines M 36-63.28, June 2015, Chapter 32, Railroad/Highway Crossing Program	Focuses on adding protection to improve safety and efficiency of railroad/highway crossings. Provides a process for investigating alternatives for improving grade-crossing safety, such as closure, consolidation, and installation of warning devices.
WSDOT Design Manual M 22.01.10, November 2015, Chapter 1350, Railroad Grade Crossings	Provides specific guidance for the design of at-grade railroad crossings.
Rail Companies—Operation (WAC 480-62)	Establishes operating procedures for railroad companies operating in Washington State.
Local	
Longview Municipal Code 11.40.080 (Railroad Trains Not to Block Streets)	Prohibits trains from using any street or highway for a period of time longer than five minutes, except trains or cars in motion other than those engaged in switching activities.

Notes:
FRA = Federal Railroad Administration; FHWA = Federal Highway Administration; CFR = Code of Federal Regulations; USC = United States Code; WUTC = Washington Utilities and Transportation Commission; WSDOT = Washington State Department of Transportation; WAC = Washington Administrative Code

The Surface Transportation Board (STB) oversees the nation's freight rail system. STB has regulatory jurisdiction over the reasonableness of rates railroads charge shippers, mergers, line acquisitions, new rail-line construction,[3] and abandonments of existing rail lines. Because the proposed export terminal would not construct new rail lines or meet the criteria of STB's other jurisdiction, it is not subject to STB review.

6.1.2 Study Area

The study area for direct impacts is the project area for both the On-Site Alternative and Off-Site Alternative. For indirect impacts, the study area includes the project area and the rail corridor of the Longview industrial area, which is defined as the rail corridor (Reynolds Lead and BNSF Spur) between the project area and the junction with the BNSF main line (Longview Junction). These study areas are based on the Corps' NEPA scope of analysis Memorandum For Record (February 14, 2014) and then adjusted to reflect the rail transportation network near the project areas.

[3] The Surface Transportation Board (STB) grants the authority to construct and operate proposed rail lines and associated facilities under 49 United States Code (USC) § 10901.

6.1.3 Methods

This section describes the sources of information and methods used to evaluate the potential impacts on rail transportation associated with the construction and operation of the proposed export terminal.

6.1.3.1 Information Sources

The following information sources were used for project-related rail operations.

- **Existing, projected, and No-Action Alternative rail traffic.** Existing and projected 2028 rail traffic for the Reynolds Lead and BNSF Spur were based on information from the Longview Switching Company (LVSW) as operator of the Reynolds Lead and BNSF Spur, information provided by the Port of Longview, and field observations.
- **Train parameters.** Train parameters including the number of rail cars per unit train and number of locomotives were based on information provided by the Applicant, input from BNSF, and existing BNSF coal train operations (BNSF Railway Company 2016).
- **Reynolds Lead, BNSF Spur, and project area operations**. Rail operations of the Reynolds Lead and BNSF Spur were based on information provided by LVSW. Rail operations in the project areas were based on information provided by the Applicant.

6.1.3.2 Impact Analysis

The following methods were used to identify the potential impacts of the proposed export terminal relevant to rail transportation in the study areas. For this analysis, potential impacts resulting from operations impacts are based on the Applicant's planned throughput capacity of up to 44 million metric tons of coal per year.

- **Train parameters.** For this analysis, all project-related trains were assumed to have the parameters shown in Table 6.1-2.
- **Rail line capacity.** The theoretical capacity[4] for the Reynolds Lead and BNSF Spur was calculated generally based on the number of main tracks, train parameters, speed, and distance.
- **Train speed and travel time.** The current maximum speed for the Reynolds Lead is 10 miles per hour (mph). The maximum speed over the Reynolds Lead could increase from 10 mph to up to 25 mph if track improvements are made by LVSW.[5] This improvement would reduce the train travel time from Longview Junction to the project areas for the On-Site Alternative and Off-Site Alternative. Because these improvements are not certain, the impact analysis includes train speeds and transit time over each road crossing with and without planned improvements to the Reynolds Lead and BNSF Spur.

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[4] Theoretical capacity is the number of trains that could run over a route in a mathematically generated environment at minimum spacing between trains.

[5] As described in Section 6.1.5, *Impacts,* the Longview Switching Company (LVSW) would likely upgrade the Reynolds Lead and BNSF Spur as needed to meet additional future volume increases.

Table 6.1-2. Parameters for Project-Related Trains

Rail Cars	
Gross rail load (tons)	143
Empty weight (tons)	21
Weight of coal (tons)	122
Coupled Length (feet)	53
Locomotives	
Length (feet)	73
Number in train[a]	3
Total Train	
Cars per train	125
Total train length (feet)	6,844

Notes:
[a] Locomotives are distributed through trains (distributed power) in various configurations. Project-related trains would likely have two locomotives at the head and one at the rear of the train (Wolter pers. comm.).

6.1.4 Affected Environment

This section describes the environment in the study areas related to rail transportation potentially affected by construction and operation of the proposed export terminal.

6.1.4.1 Project Areas

As described in Chapter 3, *Alternatives*, the project area for the On-Site Alternative is located on 190 acres, primarily within the 540-acre Applicant's leased area. The project area includes a portion of a rail loop that transitions from the Reynolds Lead onto the project area and extends from the project area to the Applicant's leased area. Rail traffic within the project area serves the existing bulk product terminal adjacent to the project area and within the Applicant's leased area as described in Chapter 3, *Alternatives*.

The project area for the Off-Site Alternative is located on an approximate 220-acre site west and downstream of the project area for the On-Site Alternative. Most of the project area for the Off-Site Alternative is within Longview city limits and owned by the Port of Longview. The remainder of the project area is within unincorporated Cowlitz County and privately owned. There are no existing rail facilities in the project area for the Off-Site Alternative.

6.1.4.2 BNSF Spur and Reynolds Lead

The project area for the On-Site Alternative is located at the end of the Reynolds Lead, an existing rail line serving the Port of Longview and several industries, and connects via the BNSF Spur to the BNSF main line. The junction of the BNSF Spur and BNSF main line is called Longview Junction (Figure 6.1-1). The speed limit on the Reynolds Lead and BNSF Spur is 10 mph. At an average speed of 9 mph, the existing travel time from Longview Junction to the project area for the On-Site Alternative is approximately 49 minutes.

The traffic control system used on the Reynolds Lead and BNSF Spur is Traffic Warrant Control (TWC). Under this control system, train crews obtain authority to occupy and move on a main track from the dispatcher in the form of a completed track warrant form. Usually the track warrant information is transmitted to the train crew by phone, radio, or electronic transmission to the locomotive.

Between Longview Junction and the project area for the On-Site Alternative there are five public and three private at-grade road crossings (Figure 6.1-1). These road crossings are affected by current rail traffic operating to and from the Port of Longview and/or from industrial switching activities at locations along the Reynolds Lead.

BNSF Spur

The BNSF Spur runs from the BNSF Seattle Subdivision main line switch at Longview Junction, across the Cowlitz River Bridge to the LVSW yard and is approximately 2.1 miles long (Figure 6.1-1). Dike Road is the only public at-grade road crossing on the BNSF Spur. There is one main track with TWC traffic control. The Cowlitz River Bridge is a manually operated drawbridge controlled by LVSW. The bridge opens once every 4 to 5 years to allow passage of river-dredging vessels. The speed limit on the BNSF Spur is 10 mph because of speed restrictions on the bridge.

Average existing traffic is approximately 7 trains per day. Capacity is approximately 24 trains per day (12 trains in each direction), which supports the current volume. The 7 trains average 78 rail cars per train and 4,920 feet in length.

Existing trains consist of an average of 4 grain trains per day (2 loaded and 2 empty) to and from the EGT grain terminal at the Port of Longview, 2 to 3 manifest trains[6] per day from the BNSF main line to the LVSW yard, and an occasional unit train of clay, soda ash, or other trains destined to or from the Port of Longview. The Port Industrial Rail Corridor connects with the BNSF Spur just east of the LVSW yard. The switch is a remotely controlled switch operated by the BNSF dispatcher. Trains to or from Port of Longview facilities leave or enter the BNSF Spur at the switch. Other trains originate or terminate in the LVSW yard.

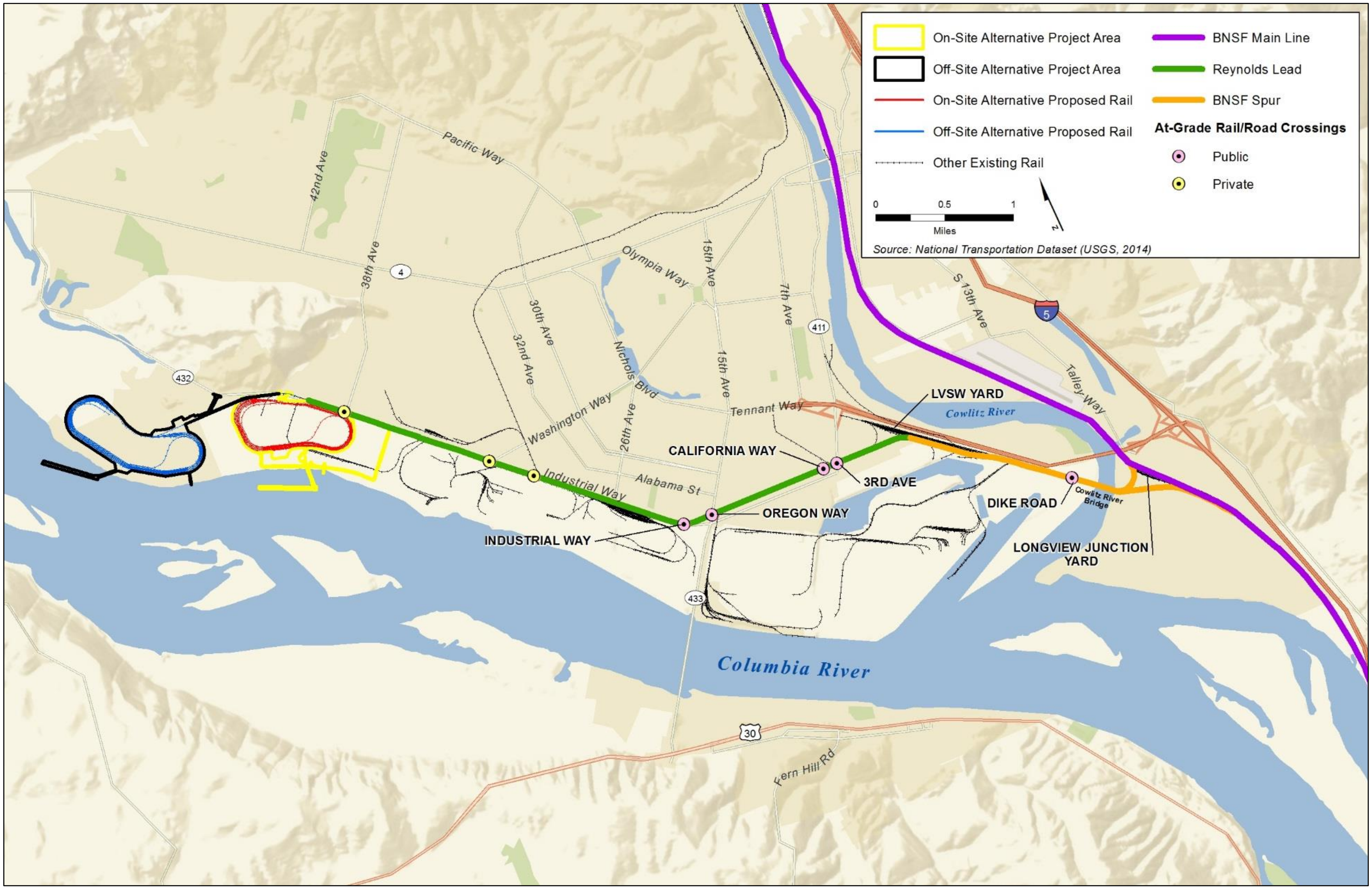
Reynolds Lead

The Reynolds Lead runs from the west end of the LVSW yard to the project area for the On-Site Alternative and is approximately 5 miles long (Figure 6.1-1). There is one main track with TWC traffic control. The speed limit is 10 mph, and capacity is approximately 24 trains per day (12 trains in each direction). Average existing traffic is approximately 2.3 trains per day. Each train averages 21 rail cars per train with an average train length of approximately 1,450 feet. There are four public at-grade road crossings on the Reynolds Lead between the LVSW yard and the project area: 3rd Avenue (State Route 432), California Way, Oregon Way (State Route 433), and Industrial Way (State Route 432) (Figure 6.1-1).

Existing trains operating on the Reynolds Lead include an LVSW local crew. The crew place and pull cars at industrial facilities along the Reynolds Lead 3 days per week, and a local crew delivers and picks up cars interchanged to and from the Columbia & Cowlitz Railway at two sidings just west of California Way. The Columbia & Cowlitz Railway also operates on the Reynolds Lead between the Weyerhaeuser plant near Industrial Way and these sidings to deliver and pick up interchange cars to or from the LVSW rail line.

[6] Unlike unit trains, manifest trains are composed of rail cars with different commodities originating in different locations and delivered to different locations.

Figure 6.1-1. Reynolds Lead and BNSF Spur



6.1.5 Impacts

This section describes the potential direct and indirect impacts related to rail transportation from construction and operation of the proposed export terminal.

6.1.5.1 On-Site Alternative

This section describes the potential impacts in the study area as a result of construction and operation of the terminal at the On-Site Alternative location.

Construction—Direct Impacts

The Reynolds Lead would be modified within the project area to accommodate unit train access to and from the export terminal. Because the project area is at the terminus of the Reynolds Lead, this construction would not affect existing rail traffic on the Reynolds Lead. Chapter 3, *Alternatives*, describes construction-related activities and scenarios to transport materials to the project area. Under the rail scenario, trains transporting construction materials would travel to and from the project area. The unloading and maneuvering of these trains during construction in the project area would not affect the operations of existing rail traffic on the Reynolds Lead.

Construction—Indirect Impacts

Construction of the On-Site Alternative would result in the following indirect impact on rail transportation if construction materials are delivered by rail.

Construction Rail Traffic on the Reynolds Lead and BNSF Spur

The Applicant estimates 2.1 million yards of suitable material would be needed for construction. This material would be transported to the project area by truck or rail, as described in Chapter 3, *Alternatives*. The Applicant estimates approximately two-thirds of the volume (1.4 million yards) would move during the first year of construction, assumed to be 2018. The Applicant has proposed moving materials by rail, which would require an estimated 350 loaded trains of 100 cars each, equivalent to 700 trains (loaded and empty) over the entire construction period. During the first year of construction, when two–thirds of the volume would be transported, this would amount to approximately 467 trains, or an average of 1.3 trains per day in 2018.

The baseline rail traffic on the BNSF Spur in 2018 is an average of 7 trains per day. Baseline rail traffic and project-related construction trains would not exceed the capacity of the Reynolds Lead and BNSF Spur.

Operations—Direct Impacts

During operations, 8 loaded trains would travel to the project area daily, and 8 empty trains would travel outbound from the project area daily. These trains would maneuver along the rail loop in the project area and would not affect rail traffic operations on the Reynolds Lead.

Operations—Indirect Impacts

Operation of the On-Site Alternative would result in the following indirect impact on rail transportation.

Rail Traffic on the BNSF Spur and Reynolds Lead

Project-related loaded trains would move from Longview Junction to the project area, and the reverse, moving empty trains from the project area to Longview Junction. This movement would add rail traffic to the BNSF Spur and Reynolds Lead. The export terminal at full throughput in 2028, would receive an average of 8 loaded trains and return an average of 8 empty trains per day. Therefore, 16 project-related trains per day would operate on the Reynolds Lead and BNSF Spur.

Capacity of the Reynolds Lead and BNSF Spur is approximately 24 trains per day. The baseline volume is an average of 7 trains per day on the BNSF Spur and 4 trains per day on the Reynolds Lead. Project-related trains would add 16 trains per day (8 loaded and 8 empty) on each of these segments for a total of 23 trains on the BNSF Spur and 20 trains on the Reynolds Lead. The Reynolds Lead and BNSF Spur have the capacity to handle current baseline rail traffic plus future project-related rail traffic.

LVSW has indicated it would expand system capacity as needed to meet additional future volume increases. LVSW would likely upgrade the traffic control technology on both the BNSF Spur and the Reynolds Lead from TWC to a Centralized Traffic Control (CTC) system.[7] However, this improvement is not currently funded or authorized.

In addition to converting to the CTC system, LVSW indicated it would upgrade the track on the Reynolds Lead and BNSF Spur by adding ballast, replacing ties, and upgrading the rails. These improvements would provide safer operation and increase maximum speed from 10 mph to 25 mph on the Reynolds Lead. The speed limit on the BNSF Spur is limited by the Cowlitz River Bridge, and so would remain at 10 mph. LVSW would also install a remotely operated electric switch connecting the BNSF Spur to the Reynolds Lead to allow continuous movement and more consistent operation. The electronic switch would eliminate the need for project-related trains to stop while a train crew member operates the switch. While LVSW has developed upgrade plans, it has not begun work or applied for permits. LVSW would start the permit and project funding processes once future volume increases become reasonably certain.

Table 6.1-3 provides additional information on anticipated operations over the Reynolds Lead and BNSF Spur, including the average time for project-related trains to cross each of the at-grade road/rail crossings with the existing track infrastructure and with the planned infrastructure improvements.

[7] With Centralized Traffic Control (CTC), electrical circuits monitor the location of trains, allowing dispatchers to control train movements from a remote location, usually a central dispatching office. The signal system prevents trains from being authorized to enter sections of track occupied by other trains moving in the opposite direction.

Table 6.1-3. BNSF Spur and Reynolds Lead At-Grade Crossing Detail for Project-Related Trains

	Dike Road	3rd Avenue	California Way	Oregon Way	Industrial Way
Current Track Infrastructure					
Estimated speed	10 mph	8 mph	8 mph	10 mph	10 mph
Estimated passing time	8 minutes	10 minutes	10 minutes	8 minutes	8 minutes
Planned Track Infrastructure					
Estimated speed	10 mph	15 mph	15 mph	20 mph	20 mph
Estimated passing time	8 minutes	5 minutes	5 minutes	4 minutes	4 minutes

Notes:
Source: ICF International and Hellerworx 2016
mph = miles per hour

6.1.5.2 Off-Site Alternative

This section describes the potential impacts that could occur in the study areas as a result of construction and operation of the proposed export terminal at the Off-Site Alternative location. Construction and operational activities would be the same or similar to those described above for the On-Site Alternative.

Construction—Direct Impacts

The Off-Site Alternative would require construction of about 2,500 feet of additional track in the project area of the Off-Site Alternative to extend the Reynolds Lead to the project area. Because the project area is at the terminus of the Reynolds Lead, this construction would not affect existing rail traffic on the Reynolds Lead. Chapter 3, *Alternatives*, describes construction-related activities and scenarios to transport materials to the project area. Under the rail scenario, trains transporting construction materials would travel to and from the project area. The unloading and maneuvering of these trains during construction in the project area would not affect the operations of existing rail traffic on the Reynolds Lead.

Construction—Indirect Impacts

Construction of the export terminal at the Off-Site Alternative location would result in the following indirect impact on rail transportation if construction materials are delivered by rail.

Construction Rail Traffic on the Reynolds Lead and BNSF Spur

This impact would be the same as the On-Site Alternative.

Operations—Direct Impacts

During operations, 8 loaded trains would travel to the project area daily, and 8 empty trains would travel outbound from the project area daily. These trains would maneuver along the rail loop in the project area. Rail traffic operations in the project area would not affect rail traffic on the Reynolds Lead because rail operations would be limited to the project area.

Operations—Indirect Impacts

Operation of the export terminal at the Off-Site Alternative location would result in the following indirect impacts on rail transportation.

Rail Traffic on the BNSF Spur and Reynolds Lead

This impact would be the same as the On-Site Alternative.

6.1.5.3 No-Action Alternative

Under the No-Action Alternative, the Corps would not issue a Department of the Army permit authorizing construction and operation of the proposed export terminal. As a result, impacts resulting from constructing and operating the export terminal would not occur. In addition, not constructing the export terminal would likely lead to expansion of the adjacent bulk product business onto the On-Site Alternative project area. A limited-scale future expansion scenario proposed by the Applicant was evaluated, as described in Chapter 3, *Alternatives*. Under this scenario, approximately 2 trains per day would use the Reynolds Lead and BNSF Spur. The existing infrastructure on the Reynolds Lead and BNSF Spur have capacity for 2 additional trains.

6.1.6 Required Permits

No permits or approvals related to rail transportation from federal, state, or local agencies would be required for the proposed export terminal.

6.2 Rail Safety

Railroads provide transportation for passengers and a wide range of commercial goods, and support regional economic activity. Similar to other forms of transportation, rail traffic is subject to various regulatory requirements to protect public safety. This section describes the regulatory setting, rail safety conditions in the study area, and potential rail safety impacts from constructing and operating the proposed export terminal.

6.2.1 Regulatory Setting

Laws and regulations relevant to rail safety are summarized in Table 6.2-1. Regulations pertaining to at-grade rail crossings are presented in Section 6.3*, Vehicle Transportation.*

Table 6.2-1. Regulations, Statutes, and Guidelines for Rail Safety

Regulation, Statute, Guideline	Description
Federal	
Federal Railroad Safety Act of 1970	Gives FRA rulemaking authority over all areas of rail line safety. FRA has designated state and local law enforcement agencies with jurisdiction over most aspects of highway/rail crossings, including warning devices and traffic law enforcement.
Highway Safety Act and the Federal Railroad Safety Act	Gives FHWA and FRA regulatory jurisdiction over safety at federal highway/rail grade crossings.
Federal Railroad Administration General Regulations (49 CFR 200–299)	Establishes railroad regulations, including safety requirements related to track, operations, and cars.
State	
Title 81, Transportation—Railroads, Employee Requirements and Regulations (RCW 81.40)	Establishes general requirements for railroad employee environment and working conditions, the minimum crew size for passenger trains, and requirements for flaggers.
Rail Companies—Clearances (WAC 480-60)	Establishes operating procedures for railroad companies in Washington State. Includes rules of practice and procedure, walkway clearances, side clearances, track clearances, and rules for operation of excess dimension loads.
Rail Companies—Operation (WAC 480-62)	Establishes railroad operating procedures in Washington State.
Local	
No local regulation, statutes, or guidelines apply to rail safety.	

Notes:
FRA = Federal Railroad Administration; FHWA = Federal Highway Administration; CFR = Code of Federal Regulations; RCW = Revised Code of Washington; WAC = Washington Administrative Code

6.2.2 Study Area

The study areas are the same for both the On-Site Alternative and Off-Site Alternative. For direct impacts on rail safety, the study area is the project area. For indirect impacts, the study area is the project area plus the rail corridor of the Longview industrial area. For the purpose of this analysis, the rail corridor of the Longview industrial area is defined as the Reynolds Lead and BNSF Spur.

6.2.3 Methods

This section describes the sources of information and methods used to evaluate the potential impacts on rail safety associated with construction and operation of the proposed export terminal. The analysis used the following definition of an accident from the Federal Railroad Administration (FRA).[1]

> Collisions, derailments, fires, explosions, acts of God, or other events involving the operation of railroad on-track equipment (standing or moving) and causing reportable damages greater than the reporting threshold for the year in which the accident/incident occurred.

The FRA reporting threshold was $10,500 in 2015. Therefore, accidents include a variety of incidents and are not limited to collisions or derailments.

6.2.3.1 Information Sources

- **Rail accident data.** Rail accident data from FRA were used as the basis for the analysis. While the Washington Utilities and Transportation Commission (WUTC) gathers information on accidents in Washington State, WUTC does not gather data on train miles traveled within the state for determining accidents per million train miles traveled.
- **Existing and project rail traffic.** Existing (2015) and projected (2028) rail traffic on the Reynolds Lead and BNSF Spur are based on field observations and estimates from the Longview Switching Company (LVSW).
- **Project-related train operations.** Future project-related rail traffic and typical unit train parameters are based on information provided by the Applicant.
- **Accident rates.** Accident rates were compiled from FRA data for the years 2012 through 2014.[2] The analysis also used published literature to identify derailment rates by track class.[3]

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[1] The Federal Railroad Administration (FRA) was created by the U.S. Department of Transportation Act of 1966. It is one of ten agencies within the U.S. Department of Transportation concerned with intermodal transportation. FRA's mission is to enable the safe, reliable, and efficient movement of people and goods. FRA has established federal regulations pertaining to the safety of interstate commerce. These regulations set standards for all railroads dealing with the interchange of railroad cars and equipment.

[2] 2014 data were the most recent available data when this analysis was conducted.

[3] FRA categorizes all tracks into track classes, segregated by maximum speed limits for freight and passenger trains. FRA maintenance and inspection requirements vary by track class.

6.2.3.2 Impact Analysis

The following methods were used to evaluate the potential rail safety impacts of the proposed export terminal.

Accident rates for BNSF freight trains, Union Pacific Railroad (UP) freight trains, and all railroads (freight and passenger trains combined) were calculated using FRA data for the three most recent years of available data (Table 6.2-2). LVSW did not have any reported train accidents in the FRA database because no accidents occurred on the Reynolds Lead or BNSF Spur during these years.

Table 6.2-2. Nationwide Train Accident Rates

	Accident Rate per Million Train Miles		
Year	**All Railroads (Passenger and Freight Trains)**	**BNSF (Freight Trains)**	**UP (Freight Trains)**
2012	2.41	2.20	3.04
2013	2.43	2.11	3.02
2014	2.27	1.89	2.82

Notes:
Source: Federal Railroad Administration (2015)
BNSF = BNSF Railway Company; UP = Union Pacific Railroad

Historically, accident rates (accidents per million train miles) do not change dramatically from year to year, but generally trend downward over time because of improved control systems, communications, and inspection practices. Given the rail transportation associated with the proposed export terminal within Washington State would be primarily BNSF trains, a rate of two accidents per million train miles, based on the data in Table 6.2-2, was used for the analysis.

FRA track safety standards establish nine specific classes of track (Class 1 to Class 9). Class of track is based on standards for track structure, geometry, and inspection frequency. Each class of track has a maximum allowable operating speed for both freight and passenger trains. The higher the class of track, the greater the allowable track speed and the more stringent the applicable track safety standard. Accident rates have been shown to vary considerably by track class, with higher accident rates occurring on lower track classes. However, lower track classes have lower maximum operating speeds, which can reduce the consequences of more frequent accidents.

Data on accident rates by track class were used to generate a baseline accident rate on the Reynolds Lead and BNSF Spur, which are currently maintained in accordance with the Track Class 1 standard. In the future, LVSW plans to upgrade the Reynolds Lead and BNSF Spur to a Track Class 2 designation.

The predicted number of accidents per year was calculated by multiplying segment length by the number of trains per year and applicable accident rate. The result was then adjusted for track classification based on published accident data research by track class. More information on these methods is provided in the *NEPA Rail Safety Technical Report* (ICF International 2016).

6.2.4 Affected Environment

Section 6.1, *Rail Transportation*, describes the affected environment. LVSW did not have any reported train accident data in the FRA database because there were no train accidents on the Reynolds Lead or BNSF Spur from 2012 to 2014.

6.2.5 Impacts

This section describes the potential direct and indirect impacts related to rail safety (in terms of predicted train accidents) from construction and operation of the proposed export terminal.

6.2.5.1 On-Site Alternative

This section describes the potential impacts on rail safety in the study area as a result of construction and operation of the proposed export terminal. Chapter 3, *Alternatives*, describes construction-related activities and scenarios for transporting materials to the project area.

Construction—Direct Impacts

Any accidents in the project area would be related to construction in the project area and would not affect rail safety on the Reynolds Lead.

Construction—Indirect Impacts

Construction-related activities associated with the On-Site Alternative could result in indirect impacts on rail safety as described below.

Potential for Train Accidents

According to the Applicant, construction materials could be delivered by rail. This would require an estimated 350 loaded trains of 100 cars each, and 350 empty trains of 100 cars each. It is anticipated two-thirds of the construction material would be transported during the first year of construction in 2018 (approximately 467 trains, an average of 1.3 trains per day). Construction trains would use the Reynolds Lead and BNSF Spur.

The predicted accident frequencies during the peak year of construction are shown in Table 6.2-3. The predicted project-related train accidents is 0.02 accident on the BNSF Spur and 0.06 accident on the Reynolds Lead in 2018.

Table 6.2-3. 2018 Predicted Train Accidents per Year during Peak Year of Construction

Segment	Length (miles)	Predicted Project-Related Train Accidents
BNSF Spur	2.1	0.02
Reynolds Lead	5.0	0.06

Operations—Direct Impacts

At full terminal capacity, 8 loaded trains would travel to the project area and 8 empty trains would travel from the project area daily. These trains would maneuver along the rail loop in the project area. The accident rates described previously are not applicable to the project area. Any accidents in the project area would be related to operations in the project area and would not affect rail safety on the Reynolds Lead.

Operations—Indirect Impacts

Operation of the export terminal would increase the potential for train accidents along the BNSF Spur and Reynolds Lead. The predicted accident frequencies in 2028 are shown in Table 6.2-4.

Table 6.2-4. 2028 Predicted Train Accidents per Year[a]

Segment	Length (miles)	2028 Project-Related Trains	2028 Baseline Conditions
BNSF Spur	2.1	0.14	0.12
Reynolds Lead	5.0	0.36	0.08

Notes:

[a] Assumes the Reynolds Lead and BNSF Spur would be improved to Class 2 standards by LVSW. If the Reynolds Lead and BNSF Spur are not improved to Class 2 standards, the predicted train accidents per year would be approximately 1.5 to 3 times higher than the Class 2 accident rate.

The following summarizes the predicted accident frequencies.

- **With track improvements to the Reynolds Lead and BNSF Spur (Track Class 2).** The predicted number of accidents is 0.50 per year (or, one accident every 2 years) for project-related trains.
- **Without track improvements to the Reynolds Lead and BNSF Spur (Track Class 1).** Accident rates for Track Class 1 are more uncertain given the small percentage of train miles on Track Class 1. Therefore, it is difficult to predict accident rates for Track Class 1. However, data indicate the 2028 project-related predicted train accidents per year in Table 6.2-4 would be approximately 1.5 to 3 times higher without planned improvements to the Reynolds Lead and BNSF Spur.

Not every accident of a loaded project-related train would result in a coal spill, and spills that do occur could vary in size. Coal spills on the Reynolds Lead or BNSF Spur would be expected to be less frequent and smaller than on a main line track due to lower train speeds. Impacts from coal spills on the natural environment are addressed in Chapter 5, Sections 5.5, *Water Quality,* 5.6, *Vegetation*, 5.7, *Fish,* and 5.8, *Wildlife*.

6.2.5.2 Off-Site Alternative

Potential direct and indirect impacts on rail safety for an export terminal constructed at the Off-Site Alternative location would be the same as those described for the On-Site Alternative. However, the predicted number of accidents for project-related trains on the Reynolds Lead would be slightly higher for the Off-Site Alternative because trains would travel approximately 0.5 mile further on the Reynolds Lead to the Off-Site Alternative project area. During operations in 2028, the predicted number of accidents for project-related trains on the Reynolds Lead would be 0.38 accident per year.

6.2.5.3 No-Action Alternative

Under the No-Action Alternative, the Corps would not issue a Department of the Army permit authorizing construction and operation of the proposed export terminal. As a result, impacts resulting from constructing and operating the terminal would not occur. In addition, not constructing the terminal would likely lead to expansion of the adjacent bulk product business onto the On-Site Alternative project area. A limited-scale future expansion scenario proposed by the Applicant was evaluated, as described in Chapter 3, *Alternatives*. Under this scenario, approximately 2 trains per day would use the Reynolds Lead and BNSF Spur (mixed-load trains). The potential for a mixed-load train accident on the Reynolds Lead and BNSF Spur would presumably be lower than for a unit train because mixed-load trains tend to not have as many rail cars as a unit train.

6.2.6 Required Permits

No permits related to rail safety would be required for the proposed export terminal.

6.3 Vehicle Transportation

Vehicles provide transportation for individuals to travel to work, school, public services, and for recreational and commercial purposes. Vehicles also are used for emergency response and for delivering commercial goods and support economic activity. Vehicle delays increase travel time for motorists and can affect quality of life, air quality, and economic growth.

This section describes vehicle transportation in the study area and the potential impacts on vehicle transportation from construction and operation of the proposed export terminal.

6.3.1 Regulatory Setting

Laws and regulations relevant to vehicle transportation are summarized in Table 6.3-1.

Table 6.3-1. Regulations, Statutes, and Guidelines for Vehicle Transportation

Regulation, Statute, Guideline	Description
Federal	
Federal Railroad Safety Act of 1970	Gives FRA rulemaking authority over all areas of rail line safety. FRA has designated state and local law enforcement agencies have jurisdiction over most aspects of highway/rail grade crossings, including warning devices and traffic law enforcement.
Highway Safety Act and the Federal Railroad Safety Act	Gives FHWA and FRA regulatory jurisdiction over safety at federal highway/rail grade crossings.
Railroad-Highway Grade Crossing Handbook (Federal Highway Administration 2007); *Manual on Uniform Traffic Control Devices* (23 USC 109(d))	Guidance document on grade-crossing safety issues, including the selection and placement of warning devices and enforcement of traffic laws. Provides guidelines for traffic control devices including delay, roadway classification, average daily traffic, number of trains per day, and train speed at grade crossings.
State	
Washington State Department of Transportation, Design Manual M 22.01.10, November 2015, Chapter 1350, Railroad Grade Crossings	Sets forth requirements and guidance on the design and treatment of state highway-rail grade crossings.
Motor Vehicles, Rules of the Road (RCW 46.61.340)	Sets forth train traffic has the right-of-way at grade crossings.
Washington Utilities and Transportation Commission	Inspects and issues violations for hazardous materials shipments; track, signal, and train control; and rail operations. WUTC also regulates the construction, closure, or modification of public railroad crossings. In addition, WUTC inspects and issues defect notices if a crossing does not meet minimum standards. However, WUTC has no jurisdiction over public crossings in first-class cities.[a]

Regulation, Statute, Guideline	Description
Local	
Longview Municipal Code 11.40.080 (Railroad Trains Not to Block Streets)	Prohibits trains from using any street or highway for a period of time longer than 5 minutes, except trains or cars in motion other than those engaged in switching activities.

Notes:
[a] Per RCW 35.01.01, a first-class city is a city with a population of 10,000 or more at the time of organization or reorganization with an adopted charter.
FRA = Federal Railroad Administration; FHWA = Federal Highway Administration; USC = United States Code; RCW = Revised Code of Washington; WUTC = Washington Utilities and Transportation Commission

6.3.2 Study Area

The study areas are the same for both the On-Site Alternative and Off-Site Alternative. The study area for direct impacts is the project area. The study area for indirect impacts is defined as the arterials and secondary roads in the vicinity of the Longview industrial area along the Columbia River between the project area and Interstate 5. This includes the following active public and private at-grade crossings of the Reynolds Lead and BNSF Spur (Figure 6.3-1):

- Project area access at 38th Avenue, south of Industrial Way (State Route [SR] 432)
- Weyerhaeuser access at Washington Way, south of Industrial Way
- Weyerhaeuser North Pacific Paper Corporation (NORPAC) access, south of Industrial Way
- Industrial Way, west of Oregon Way (SR 433)
- Oregon Way, north of the Industrial Way/Oregon Way intersection
- California Way, north of Industrial Way
- 3rd Avenue (SR 432), north of the 3rd Avenue/Industrial Way intersection
- Dike Road, south of Tennant Way

6.3.3 Methods

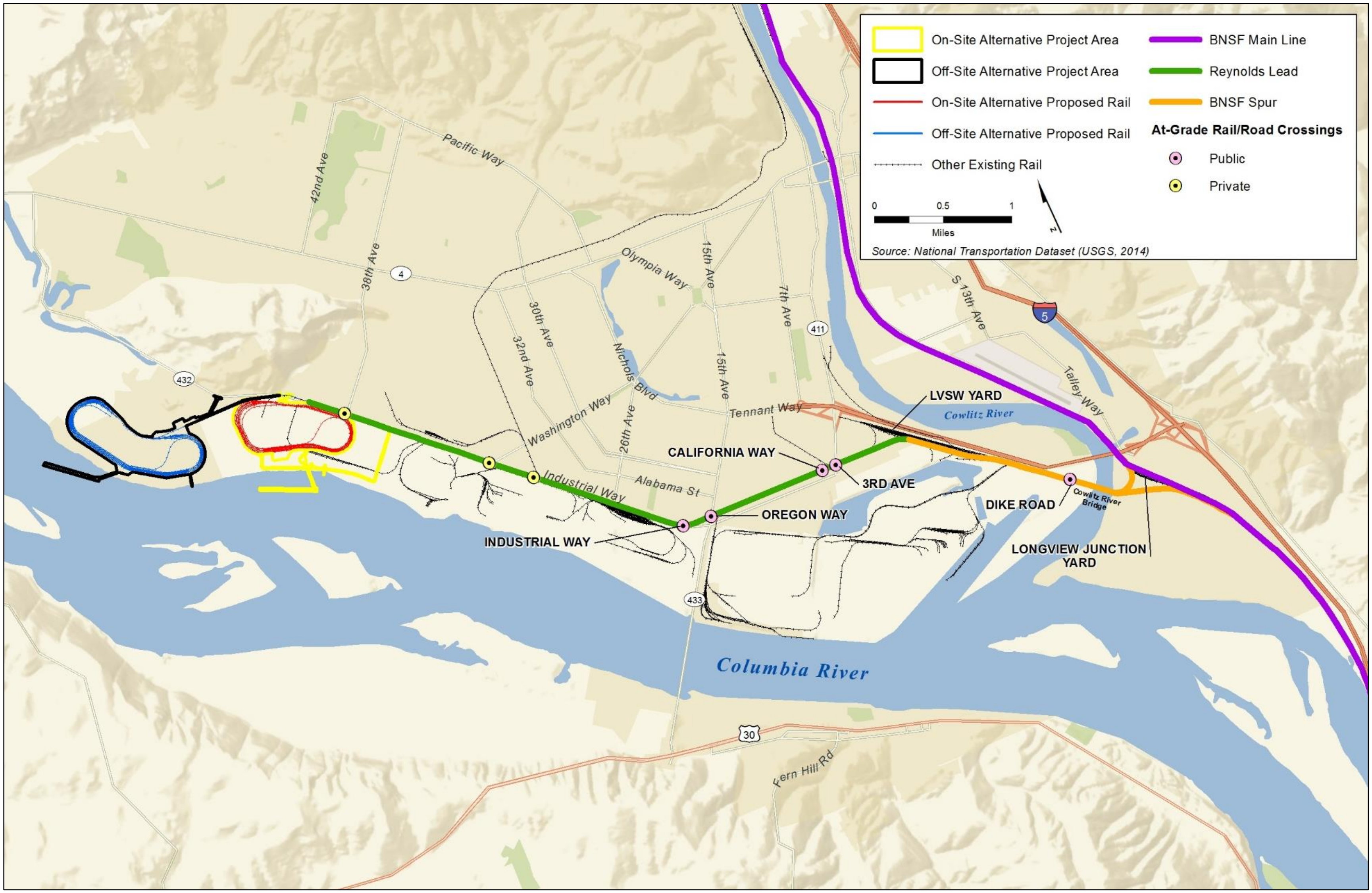
This section describes the sources of information and methods used to evaluate the potential impacts on vehicle transportation associated with the construction and operation of the proposed export terminal. For additional information, see the *NEPA Vehicle Transportation Technical Report* (ICF International and DKS Associates 2016b).

6.3.3.1 Information Sources

The following sources of information were used to identify potential impacts of the proposed export terminal on vehicle transportation in the study areas.

- Data provided by the Washington Utilities and Transportation Commission (WUTC)
- U.S. Department of Transportation (USDOT) Grade Crossing Inventory, Federal Railroad Administration (FRA)
- *SR 432 Highway Improvements and Rail Realignment Study* (Cowlitz-Wahkiakum Council of Governments 2014)
- Traffic volume data provided in local studies
- Data and information provided by the Applicant

Figure 6.3-1. Reynolds Lead and BNSF Spur Study Crossings



6.3.3.2 Impact Analysis

This section describes the methods used to evaluate the potential impacts on vehicle transportation associated with the construction and operation of the proposed export terminal.

The potential vehicle impacts addressed in this analysis include changes in average vehicle delay in a 24-hour period (average vehicle delay), changes in peak hour vehicle delay, changes in vehicle queuing, and changes to vehicle safety. Unlike passenger trains, freight trains do not run on a schedule. Railroad companies evaluate each situation and dispatch trains based on a number of criteria, including available crew, number of cars, cost of fuel, and overall revenue. Analysis and projection of rail impact operations requires analyzing the rail traffic and identifying typical operations. Because freight trains do not operate on a schedule, the 24-hour average vehicle delay was analyzed to represent the typical delay for drivers in the study area. The potential increase in vehicle delay during the PM (afternoon) peak hour was also analyzed to identify the highest anticipated vehicle delay impacts.

Analysis Scenarios

The following scenarios were analyzed.

- **2018 No-Action**. This scenario represents conditions in 2018 without construction of the terminal. This scenario includes activities currently ongoing and planned for the existing bulk product terminal within the Applicant's leased area, as described in Chapter 3, *Alternatives*.
- **2018 Export Terminal Construction**. This scenario represents the construction year for the export terminal with the most construction vehicle traffic. It assumes the motor vehicle and train volumes from the 2018 No-Action scenario, but with the added traffic and rail growth related to construction of the terminal. It also assumes the planned project area activities included in the 2018 No-Action scenario. This scenario considers two alternative assumptions: construction materials would be delivered by truck (Truck Delivery), and construction materials would be delivered by rail (Rail Delivery), as described in this section.
- **2028 No-Action**. This scenario represents conditions without the export terminal in 2028. It includes the motor vehicle and train volumes from the 2018 No-Action scenario, but with added growth to represent estimated 2028 traffic conditions. It also assumes some expansion of the existing bulk product terminal activities.
- **2028 Export Terminal**. This scenario represents conditions during full operation of the export terminal in 2028. It includes the motor vehicle and train volumes from the 2028 No-Action scenario, but with the added traffic and train growth related to full operation of the terminal. It also assumes the planned and potential expansion of the existing bulk product terminal activities included in the 2028 No-Action scenario. This scenario also considers the potential effect of track improvements along the Reynolds Lead and BNSF Spur.

The *SR 432 Highway Improvements and Rail Realignment Study* completed in September 2014 (Cowlitz-Wahkiakum Council of Governments 2014) developed various design concepts for rail and highway improvements to improve safety, mobility, congestion, and freight capacity. The top concept from this study was a grade-separated intersection at Industrial Way (SR 432)/Oregon Way (SR 433). This project, called the Industrial Way/Oregon Way Intersection Project and led by Cowlitz County Public Works, is currently in the preliminary design and National Environmental

Policy Act (NEPA) and Washington State Environmental Policy Act (SEPA) environmental compliance phase to address traffic congestion, freight mobility, and safety issues at this intersection. At-grade and grade-separated options are being evaluated. The 2015 transportation package passed by the Washington State Senate includes $85 million to construct the preferred alternative identified after the conclusion of the NEPA and SEPA processes. This project was not included in the vehicle transportation analysis because a preferred alternative for the intersection has not been identified. The other concepts identified in the *SR 432 Highway Improvements and Rail Realignment Study* were not included in the vehicle transportation analysis for the proposed export terminal because funding for implementation has not been secured.

Construction Impact Analysis

The Applicant has identified three construction-material-delivery scenarios: delivery by truck, rail, or barge.

- **Truck.** If material is delivered by truck, it is assumed approximately 88,000 truck trips would be required over the construction period. Approximately 56,000 loaded trucks would be needed during the peak construction year.
- **Rail.** If material is delivered by rail, it is assumed approximately 35,000 loaded rail cars would be required over the construction period. Approximately two-thirds of the rail trips would occur during the peak construction year.
- **Barge.** If material is delivered by barge, it is assumed approximately 1,130 barge trips would be required over the construction period. Approximately two-thirds of the barge trips would occur during the peak construction year. Because the project area does not have an existing barge dock, the material would be off-loaded at an existing dock elsewhere on the Columbia River and transported to the project area by truck.

For the vehicle transportation analysis, the barge scenario is functionally the same as the truck scenario because materials would be transferred from barge to truck and delivered to the project area by truck.

The analysis of potential vehicle transportation impacts during the peak construction year is based primarily on information provided by the Applicant, as documented in the *NEPA Vehicle Transportation Technical Report*, including the following.

- The amount of construction material delivered to the project area via truck or rail (applicable to all three construction material delivery scenarios).
- Daily and peak hour estimates of construction truck traffic to deliver materials (applicable to the truck delivery and barge delivery construction material delivery scenarios).
- Average number of daily construction trains (rail delivery construction material delivery scenario).
- Daily and peak hour construction worker vehicle traffic (applicable to all three construction material delivery scenarios).

Operations Impact Analysis

Full operations of the proposed export terminal (up to 44 million metric tons of coal per year) would add 16 new daily train trips (8 loaded and 8 empty trains), each an average of 6,844 feet long (approximately 1.3 miles).

Trip Generation and Trip Distribution

Based primarily on estimates provided by the Applicant, approximately 135 employees would be needed to operate the terminal.

Construction and operations traffic generated by the terminal was distributed onto the transportation network based on current traffic patterns in the study area. For the construction materials delivered to the project area by truck, it is assumed 75% of the trucks would arrive from the east using 3rd Avenue, and 25% from the south along Oregon Way. For the construction workers and terminal employees, it is assumed 60% of the traffic would arrive from the north using Washington Way (35%) and Oregon Way (25%), 15% from the south along Oregon Way, 20% from the east along 3rd Avenue, and 5% from the west along Industrial Way.

Baseline and Future Volumes

The following describes the baseline and future vehicular and train volumes.

Vehicles

Vehicle traffic count data were obtained from recent studies for the study crossings. Where recent traffic count data were unavailable, average daily traffic volumes were obtained from the FRA or WUTC databases and estimated PM peak hour traffic volumes were derived from the average daily traffic volumes. Hourly traffic volumes over 3 days were compared at select locations to identify a peak hour, which was identified as 4:00 p.m. to 5:00 p.m. The data also indicated the PM peak hour (hereafter referred to as peak hour) represents approximately 10% of the daily traffic volume. This factor was used to convert count data from peak hour to average daily traffic or vice versa.

Traffic volumes in 2018 and 2028 included a combination of background traffic, as well as growth associated with the proposed terminal. Year 2028 background traffic was estimated by developing a linear growth rate between existing and forecast traffic volumes in the immediate area. These data suggest traffic volumes will increase 2% annually. For comparison purposes, a 2% annual growth rate was applied to expand older count data to reflect baseline traffic conditions in the *SR 432 Highway Improvements and Rail Realignment Study* completed in September 2014 (Cowlitz-Wahkiakum Council of Governments 2014). Therefore, the 2% annual growth rate was applied to the collected count data to develop 2018 No-Action scenario traffic volumes, and to the 2018 No-Action scenario traffic volumes for 10 years to develop 2028 No-Action scenario traffic volumes. Table 6.3-2 illustrates the average daily traffic and peak hour count data for all study crossings.

Table 6.3-2. Motor Vehicle and Train Volumes at Study Crossings by Scenario

Crossing Name (USDOT Crossing ID)	Time Period	2018 No-Action Scenario		2018 Export Terminal Construction (Truck Delivery) Scenario		2018 Export Terminal Construction (Rail Delivery) Scenario		2028 No-Action Scenario		2028 Export Terminal Scenario	
		Vehicle	Train	Vehicle	Train	Vehicle	Train	Vehicle	Train	Vehicle	Train
Project area access at 38th Avenue	Per Day	200	2.3	2,850	2.3	2,000	3.6	250	4.0	1,340	20.0
	Peak Hour	20	1	285	1	200	1	25	1	134	1 or 2
Weyerhaeuser access at Washington Way	Per Day	3,300	2.3	3,300	2.3	3,300	3.6	3,900	4.0	3,900	20.0
	Peak Hour	330	1	330	1	330	1	390	1	390	1 or 2
Weyerhaeuser NORPAC access	Per Day	650	2.3	650	2.3	650	3.6	800	4.0	800	20.0
	Peak Hour	65	1	65	1	65	1	80	1	80	1 or 2
Industrial Way-SR 432 (101806G)	Per Day	10,100	2.3	12,000	2.3	11,200	3.6	11,450	4.0	12,100	20.0
	Peak Hour	1,010	1	1,200	1	1,120	1	1,145	1	1,210	1 or 2
Oregon Way-SR 433 (101805A)	Per Day	15,200	2.3	15,650	2.3	15,650	3.6	18,500	4.0	18,770	20.0
	Peak Hour	1,520	1	1,565	1	1,565	1	1,850	1	1,877	1 or 2
California Way (101821J)	Per Day	4,050	2.3	4,050	2.3	4,050	3.6	4,800	4.0	4,800	20.0
	Peak Hour	405	1	405	1	405	1	480	1	480	1 or 2
3rd Avenue-SR 432 (101826T)	Per Day	16,850	2.3	17,850	2.3	17,200	3.6	20,500	4.0	20,720	20.0
	Peak Hour	1,685	1	1,785	1	1,720	1	2,050	1	2,072	1 or 2
Dike Road (101791U)	Per Day	950	7.1	950	7.1	950	8.4	1,100	7.1	1,100	23.1
	Peak Hour	95	1	95	1	95	1	110	1	110	1 or 2

Notes:
USDOT = U.S. Department of Transportation

Trains

Section 6.1, *Rail Transportation*, describes methods to estimate the types, numbers, and speed of trains between the project area and Longview Junction in 2018 and 2028. As described in Section 6.1, *Rail Transportation*, Longview Switching Company (LVSW) plans to upgrade the Reynolds Lead and BNSF Spur as a separate action should it be warranted by increased rail traffic from current and future customers. Upgrades would include replacing ballast, ties, and rails to provide safer operation and allow increased train speed. LVSW would also install signals and upgrade traffic control and switching systems to increase capacity. Because these improvements are not certain, the vehicle transportation impact analysis analyzes both current track infrastructure and with planned track improvements.

Table 6.3-2 illustrates the assumed number of trains for each scenario in 2018 and 2028. In summary, Table 6.3-2 shows the following.

- The 2018 Export Terminal Construction (Rail Delivery) scenario would add an average of 1.3 train trips per day during the peak construction year at study crossings on the Reynolds Lead and BNSF Spur. It was assumed 1 project-related train could travel during the peak hour. The 2018 Construction (Truck Delivery) scenario would not add any trains to the Reynolds Lead or BNSF Spur.
- The 2028 Export Terminal scenario would add 16 trains per day to the Reynolds Lead and BNSF Spur. It was assumed 1 project-related train could travel during the peak hour with current track infrastructure on the Reynolds Lead and BNSF Spur, and up to 2 project-related trains could travel during the peak hour with planned track infrastructure on the Reynolds Lead and BNSF Spur.

Railroad Crossing Performance Measures

The following performance measures were used to determine adverse impacts and are defined below.

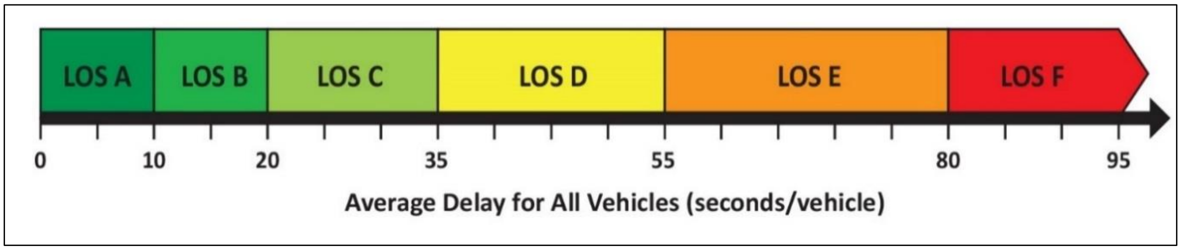
- **Level of service:** A study crossing that would operate below level of service D that would not otherwise operate below level of service D under the No-Action scenario for the same year.
- **Vehicle Queuing:** An estimated queue length that would extend from a study crossing that exceeds available storage length (to an adjacent intersection) that would not otherwise exceed the available storage length under the No-Action scenario for the same year.
- **Vehicle safety:** A study crossing with a predicted accident probability above 0.04 accident per year with the proposed export terminal but at or below 0.04 accident per year under the No-Action scenario for the same year.

The following section provides additional information on the performance measures.

Level of Service

Level of service represents a "report card" rating (A through F) based on the delay experienced by vehicles at an intersection, or in this case, a railroad crossing, as shown in Figure 6.3-2. Levels of service A, B, and C indicate conditions where traffic moves without substantial delay. Levels of service D and E represent progressively worse operating conditions. Level of service F represents conditions where average vehicle delay has become excessive and demand has exceeded capacity.

Figure 6.3-2. Level of Service



According to Washington State Department of Transportation (WSDOT) level of service standards (2010), level of service D or better is acceptable for urban highways. The transportation element of the *City of Longview Comprehensive Plan* (December 2006) defines a capacity deficiency on arterial segments as a volume-to-capacity ratio of 0.85 or higher (representing a generalized level of service of D or worse). As a conservative approach, level of service D (average delay for all vehicles equal to or less than 55 seconds) was applied as a standard at all study crossings, regardless of the street functional classification or jurisdiction. An adverse level of service impact was defined as a study crossing that operates below level of service D with the proposed export terminal when it would not otherwise operate below level of service D under the No-Action scenario for the same year.

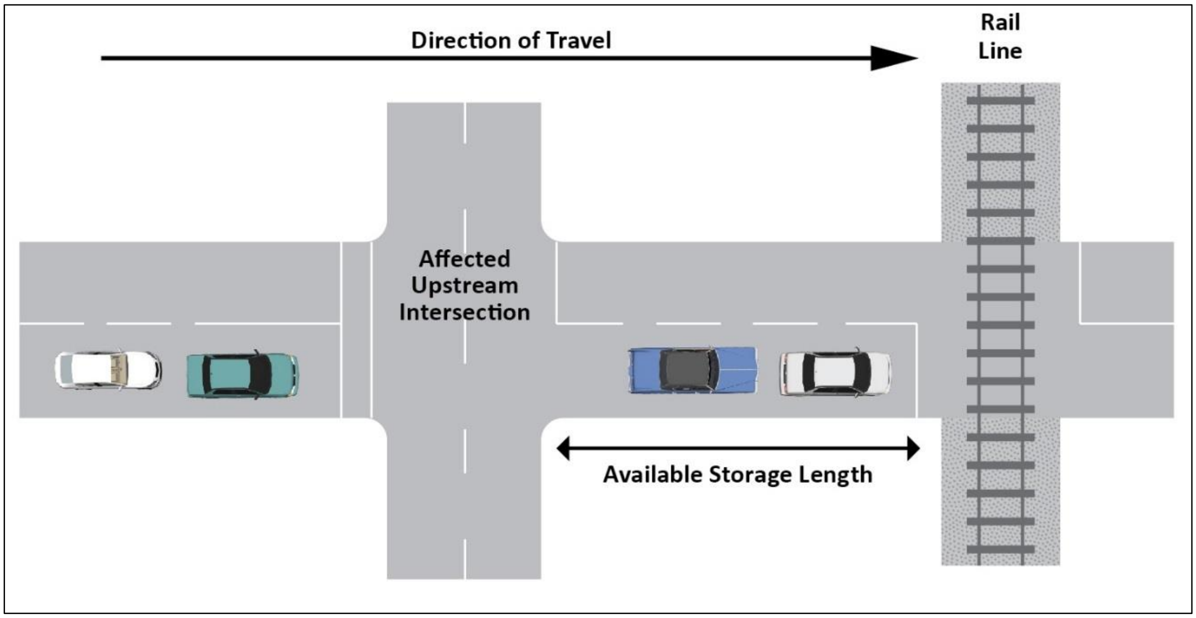
For the 24-hour vehicle delay analysis, the traffic operating conditions at the study crossings were determined based on the *2000 Highway Capacity Manual* (Transportation Research Board 2000) methods for signalized intersections (the at-grade railroad crossings were assumed to be pre-timed traffic signals). The average delay per vehicle in a 24-hour period (in seconds) for a rail crossing was determined based on the average number of daily trains, average train length, train speed, and average daily traffic volumes in both directions. This average vehicle delay in seconds per vehicle was then converted to the applicable level of service designation (Figure 6.3-2) for comparison with the No-Action scenario.

The same methods were used for the peak hour analysis. The average vehicle delay in the peak hour (in seconds) for a rail crossing was determined based on the peak hour number of trains, average train length, train speed, and peak hour traffic volume in both directions. This average vehicle delay in seconds per vehicle was then converted to the applicable level of service designation (Figure 6.3-2) for comparison with the No-Action scenario.

Vehicle Queuing

Each study grade crossing has a storage length to store vehicles when the crossing is blocked. The available storage length is the distance between the crossing and the next intersection (upstream intersection), as shown in Figure 6.3-3. As vehicles queue, the distance vehicles extend back from the crossing while waiting at a blocked crossing increases.

Figure 6.3-3. Vehicle Queuing



Queuing analysis was conducted using SimTraffic™ 8, which estimates the 95th percentile vehicle queue lengths, or the queue length not be exceeded in 95% of the queues formed during the peak hour.

An adverse vehicle queuing impact was defined as a queue from a study crossing exceeding the available storage length (to an adjacent intersection) with the proposed export terminal that would not otherwise exceed the available storage under the No-Action scenario from the same year.

Vehicle Safety

An accident probability analysis was conducted for the study crossings using the FRA GradeDec.Net web-based software, which estimates the predicted annual accident probability at a crossing in a year. The probability uses USDOT's Accident Prediction and Severity model. This model estimates accident probability based on numerous grade crossing features available in FRA's nationwide inventory of at-grade crossings, including the type of crossing protection in place, historical accident data at the crossing, vehicle traffic volumes, the number of roadway lanes and train tracks, the number of trains per day, and train speed. Other physical factors affecting the probability of collisions at a crossing, such as available sight distance, are not direct inputs in this model. However, the accident history at these crossings would likely reflect these characteristics, and such characteristics would not be affected by the proposed export terminal, which would only alter the number of trains per day and vehicle traffic volumes (at some grade crossings). This analysis provides a frame of reference for crossings by estimating accident probability, but does not identify these crossings as unsafe.

Based on other applications of the model, an adverse vehicle safety impact was defined as a study crossing with a predicted accident probability above 0.04 accident per year with the proposed export terminal that would be at or below 0.04 accident per year under the No-Action scenario.

6.3.4 Affected Environment

This section describes the affected environment in the study areas related to vehicle transportation potentially affected by the construction and operation of the proposed export terminal.

6.3.4.1 Study Crossing Characteristics

Table 6.3-3 provides vehicle and train traffic information at the study crossings on the Reynolds Lead and BNSF Spur. Roadway characteristics are also listed, including roadway functional classifications and number of lanes at the crossing. The following describes vehicle safety at study crossings and emergency service providers.

Table 6.3-3. Study Crossing Characteristics

Crossing Name (USDOT Crossing ID)	Roadway			Railroad (Trains)		
	Estimated AADT	Functional Classification[a]	Lanes	Protection[b]	Crossings per Day	Average Speed (mph)[c]
Project area access at 38th Avenue	200	Private	2	None	2.3	5 (freight)
Weyerhaeuser access at Washington Way	3,300	Private	4	None	2.3	8 (freight)
Weyerhaeuser NORPAC access	650	Private	2	None	2.3	10 (freight)
Industrial Way-SR 432 (101806G)	10,100	Principal Arterial	2	Overhead Lights	2.3	10 (freight)
Oregon Way- SR 433 (101805A)	15,200	Principal Arterial	4	Gates/ Overhead Lights	2.3	10 (freight)
California Way (101821J)	4,050	Minor Arterial	2	Overhead Lights	2.3	8 (freight)
3rd Avenue- SR 432 (101826T)	16,850	Principal Arterial	4	Gates/ Overhead Lights	2.3	8 (freight)
Dike Road (101791U)	950	Local	2	Overhead Lights	7.1	10 (freight)

Notes:
[a] Source: City of Longview 2015.
[b] Source: Field observations.
[c] Source: ICF International and Hellerworx 2016c.
USDOT = U.S. Department of Transportation; AADT = annual average daily traffic; mph = miles per hour

Vehicle Safety

Ten years of collision records (2003 to 2013) for the at-grade railroad crossings along the Reynolds Lead and BNSF Spur were obtained from FRA and WSDOT databases. The data identified one vehicle collision involving a train in the study area—at the Washington Way crossing, just south of the

Industrial Way intersection. The crossing is ungated and located less than 50 feet from Industrial Way. The collision involved a vehicle stopped at the traffic signal, beyond the stop bar and on the track, getting struck by a train. The collision resulted in property damage only.

Emergency Services

The Cowlitz 2 Fire & Rescue District, Longview Fire Department, and American Medical Response (AMR) provide emergency medical services and fire protection for the project areas. The service providers are briefly described below; additional information on the stations, facilities, and apparatus of each is provided in the *NEPA Social and Community Resources Technical Report* (ICF International and BergerABAM 2016a).

Cowlitz 2 Fire & Rescue provides fire protection services, and serves approximately 34,000 citizens in the City of Kelso and unincorporated Cowlitz County, responding to approximately 4,100 calls per year (Cowlitz 2 Fire & Rescue 2015). The district is staffed by approximately 120 full-time and volunteer members in five active fire stations, two of which are staffed with full-time EMT and paramedic firefighters. Volunteer firefighter EMTs also respond on an on-call basis. Figure 6.3-4 illustrates the fire stations in the Longview-Kelso area.

The Longview Fire Department serves approximately 36,000 citizens spread over 14.7 square miles of urban and suburban development. The department is staffed with 39 full-time EMT/firefighters, and 4 paramedic/firefighters. Paramedic transport service is provided within the city by AMR, a private provider. The Longview Fire Department responds to approximately 4,500 calls per year from two fire stations (City of Longview 2015).

AMR is a private ambulance company providing emergency and nonemergency medical transport service. AMR includes approximately 35 paramedics and EMTs, and handles an average of 7,500 calls annually (American Medical Response 2015). The medical transport vehicles are based out of the facility near the Cowlitz Way intersection with Long Avenue.

6.3.5 Impacts

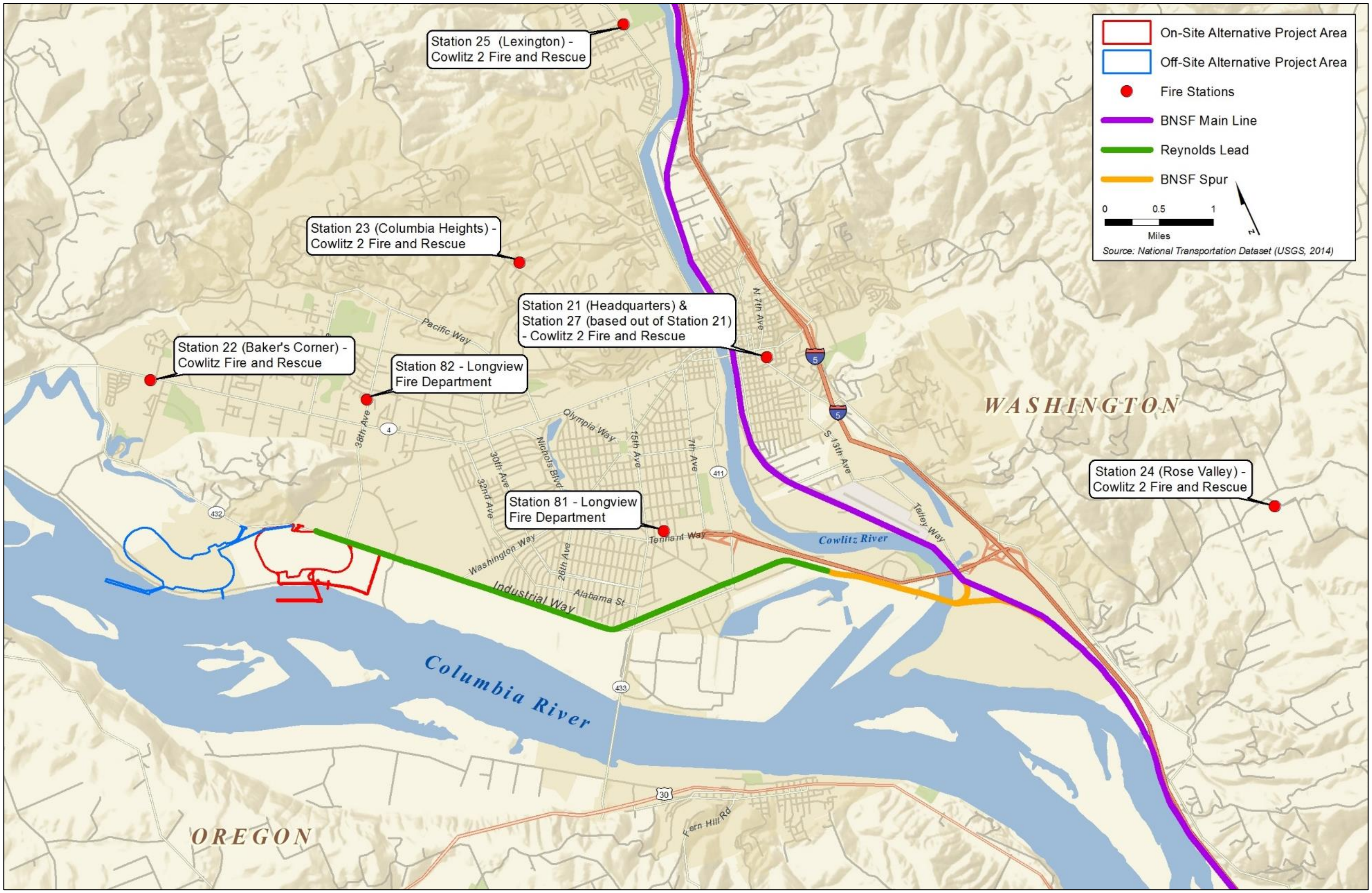
This section describes the potential direct and indirect impacts related to vehicle transportation from construction and operation of the proposed export terminal. For more detailed information, see the *NEPA Vehicle Transportation Technical Report*.

6.3.5.1 On-Site Alternative

Construction—Direct Impacts

Vehicle transportation in the project area during construction would not have a direct impact on vehicle transportation outside the project area. An estimated 1,800 motor vehicle trips per day are estimated as a result of peak construction activities with the rail delivery scenario, or an estimated 2,650 motor vehicle trips per day with the truck delivery scenario. These vehicles would access the project area via the private driveway opposite 38th Avenue or a new driveway on Industrial Way. Parking would be provided for construction workers in the Applicant's leased area.

Figure 6.3-4. Fire Stations in the Kelso-Longview Area



Construction—Indirect Impacts

The rail delivery scenario would add an average of 1.3 train trips per day during the peak construction year in 2018. One project-related construction train would take between 8 and 9 minutes to pass through each at-grade crossing along the Reynolds Lead and BNSF Spur.

Vehicle Delay

24-Hour Average Vehicle Delay

All study crossings would operate at level of service A in 2018, indicating a low impact on average daily vehicle delay from project-related construction trains at the at-grade crossings on the Reynolds Lead and BNSF Spur. As shown in Table 6.3-4, the estimated average delay for all vehicles in a 24-hour period would be up to 10 seconds at the study crossings with the truck delivery and rail delivery scenarios. The transport of construction materials by truck and rail would not have an adverse impact on average vehicle delay at the study crossings along the Reynolds Lead and BNSF Spur because all study crossings would continue to operate at level of service A.

Peak Hour Vehicle Delay

Over a 24-hour period, vehicle delay from a project-related construction train would be highest during the peak hour. This analysis evaluates the potential impacts if a project-related construction train travels over the BNSF Spur and Reynolds Lead during the peak hour as a potential worst-case analysis for vehicle delay during construction. For the rail delivery scenario, the probability that a construction train would travel during the peak hour is approximately 5% each day. Thus, it is unlikely a project-related construction train would travel through study crossings during the peak hour on a given day. Vehicle delay at study crossings would be lower than presented in this subsection if a project-related construction train travels outside of the peak hour (during the other 23 hours of the day). The analysis in the previous subsection represents the 24-hour average vehicle delay for all drivers and is therefore more representative of overall vehicle delay at the study crossings in 2018.

Table 6.3-5 illustrates the estimated peak hour vehicle delay at the study crossings on the Reynolds Lead and BNSF Spur by scenario in 2018.

Under the truck delivery scenario, all study intersections would operate at level of service A, B, or C, and, therefore, the truck delivery scenario would not have an adverse impact on vehicle delay at the study crossings. If a project-related construction train travels during the peak hour, two public study crossings (California Way and 3rd Avenue) and one private study crossing (project area access at 38th Avenue) would operate below level of service D (standard used for the analysis), meaning the average delay at these crossings during the peak hour would be more than 55 seconds. Project-related construction trains would have an adverse impact at these three study crossings if a project-related construction train travels during the peak hour.

Table 6.3-4. Estimated 24-Hour Average Level of Service at Reynolds Lead and BNSF Spur Study Crossings in 2018 by Scenario

		On-Site Alternative Construction	
Crossing	No-Action Scenario	Truck Delivery Scenario	Rail Delivery Scenario[a]
Project Area Access at 38th Avenue	A	A	A
Weyerhaeuser Access at Washington Way	A	A	A
Weyerhaeuser NORPAC Access	A	A	A
Industrial Way	A	A	A
Oregon Way	A	A	A
California Way	A	A	A
3rd Avenue	A	A	A
Dike Road	A	C	A

Notes:

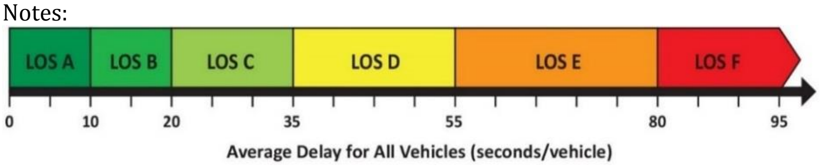
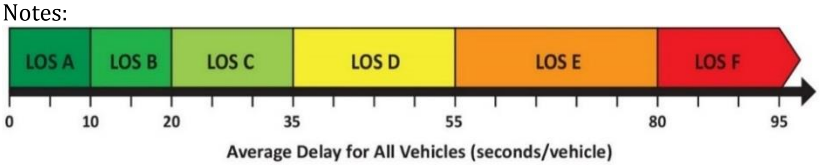


Table 6.3-5. Estimated Peak Hour Level of Service at Reynolds Lead and BNSF Spur Study Crossings in 2018 by Scenario

		On-Site Alternative Construction	
Crossing	No-Action Scenario	Truck Delivery Scenario	Rail Delivery Scenario[a]
Project Area Access at 38th Avenue	B	B	**F**
Weyerhaeuser Access at Washington Way	A	A	D
Weyerhaeuser NORPAC Access	A	A	C
Industrial Way	A	A	D
Oregon Way	A	A	D
California Way	A	A	**E**
3rd Avenue	B	B	**E**
Dike Road	C	C	C

Notes:



[a] The On-Site Alternative would result in this level of service only if a project-related construction train travels during the peak hour. **Bolded, shaded gray** values indicate an adverse level of service impact (a study crossing that operates below level of service D under the On-Site Alternative that would not otherwise operate below level of service D under the No-Action scenario for the same year).

Queuing

Increased vehicle delay from trains blocking at-grade crossings can affect nearby intersections. As vehicles begin to queue while waiting for the crossing to reopen, increased roadway congestion can affect upstream intersections. Over a 24-hour period, queue lengths would be highest if a project-related construction train travels during the peak hour. This queuing analysis evaluates the potential impacts if a project-related construction train travels during the peak hour as a potential worst-case analysis for queue lengths during construction. For the rail delivery scenario, the probability that a construction train would travel during the peak hour is an average of approximately 5% each day, and it is unlikely a project-related construction train would travel during the peak hour every day. Queue lengths at study crossings would be lower than presented in this subsection if project-related trains travel outside of the peak hour (during the other 23 hours of the day).

Table 6.3-6 illustrates estimated 2018 queue lengths if a project-related construction train travels during the peak hour. Table 6.3-6 also illustrates the estimated queue length under the No-Action scenario for comparison.

Two queue lengths under the 2018 Proposed Export Terminal Construction (Rail Delivery) scenario would exceed the available storage length that would not be exceeded under the No-Action scenario.

- Vehicles traveling to Weyerhaeuser on Washington Way would queue on Washington Way at the Washington Way/Industrial Way intersection if a project-related construction train travels during the peak hour. Because the queue would block the left-turn lane to Industrial Way and would not occur under the No-Action scenario, a project-related construction train would have an adverse impact on this queue.
- Vehicles traveling southbound on Oregon Way would queue on Oregon Way at the Reynolds Lead crossing of Oregon Way if a project-related construction train travels during the peak hour. Because the queue length on Oregon Way would exceed the available storage length (extend to Alabama Street) and would not be exceeded under the No-Action scenario, a project-related construction train would have an adverse impact on this queue.

These adverse queue impacts would only occur if a construction train travels during the peak hour (an average probability of approximately 5% each day).

Emergency Vehicle Response

The vehicle delay analysis in the previous subsection illustrates how the average vehicle delay for all vehicles, including emergency vehicles, would change with project-related construction trains. Average vehicle delay would increase under the rail delivery scenario because trains transporting construction materials would operate on the Reynolds Lead and BNSF Spur. Total gate downtime is estimated to be up to 12 minutes longer per day than the No-Action scenario at public crossings along the Reynolds Lead and BNSF Spur. In a 24-hour period, construction trains would increase the probability of an emergency response vehicle being delayed by 1% at all study crossings along the Reynolds Lead and BNSF Spur.

Table 6.3-6. Estimated 2018 Peak Hour Vehicle Queue Lengths by Scenario[a]

Crossing Name	Road Movement[b]	2018 No-Action	2018 Truck	2018 Rail	Intersection Affected by Queue from Crossing	Intersection Movement[c]	2018 No-Action	2018 Truck	2018 Rail
		Estimated Crossing Queue Length (feet)					Estimated Intersection Queue Length (feet)		
Project Area Access at 38th Avenue	NB	40	1,960	2,480	Industrial Way/ 38th Avenue	WBL	20	20	20
	SB	20	20	20		EBR	20	20	20
Weyerhaeuser Access at Washington Way	NB	140	160	460	Industrial Way/ Washington Way	WBL	120	120	140
						EBR	40	40	40
	SB	120	120	160		SBT	60	60	160
Weyerhaeuser NORPAC Access	NB	60	60	140	Industrial Way/ NORPAC Access	WBL	20	20	20
	SB	20	20	20		EBR	20	20	20
Industrial Way	NB	360	360	420	Industrial Way/ Weyerhaeuser	EBL	140	140	240
	SB	280	360	1,220		NBT	240	240	300
Oregon Way	NB	660	640	2,460	Industrial Way/ Oregon Way	NBT	440	420	2,240
						EBL	180	240	240
						WBR	100	100	100
	SB	200	220	960	Oregon Way/ Alabama Street	EBR	N/A	N/A	120
						WBL			100
						SBT			260
California Way	NB	100	100	260	Industrial Way/ California Way	N/A	N/A	N/A	N/A
	SB	120	140	600					
3rd Avenue	NB	1,040	1,060	1,640	3rd Avenue/ Industrial Way	WBR	60	60	80
						NBT	640	660	1,240
					Industrial Way/ California Way	SBL	120	120	140
	SB	240	280	1,240		NBR	60	60	60
						EBT	400	420	1,000

Crossing Name	Road Movement[b]	2018 No-Action	2018 Truck	2018 Rail	Intersection Affected by Queue from Crossing	Intersection Movement[c]	2018 No-Action	2018 Truck	2018 Rail
		Estimated Crossing Queue Length (feet)					Estimated Intersection Queue Length (feet)		
Dike Road	NB	60	60	100	None	N/A	N/A	N/A	N/A
	SB	100	100	120					

Notes:

[a] Shaded gray values indicate a study crossing or intersection queue that exceeds available storage for the scenario. Shaded black values indicate an adverse queuing impact.

[b] Roadway movement approaching the rail crossing; NB = northbound; SB = southbound; EB = eastbound; WB = westbound

[c] Movement at nearby intersection affected by queue from rail crossing; NBL = northbound left; NBR = northbound right; NBT = northbound through; SBL = southbound left; SBR = southbound right; SBT = southbound through; EBL= eastbound left; EBR= eastbound right; EBT= eastbound through; WBL= westbound left; WBR= westbound right; WBT= westbound through

The impact on emergency vehicle response would depend on the location of the origin and destination of the response incident in relation to the at-grade crossings along the Reynolds Lead and BNSF Spur. The potential for a project-related construction train to affect emergency response would also depend on whether the dispatched emergency vehicle would need to cross the rail line and the availability of alternative routes if a project-related construction train occupies the crossings at the time of the call.

Predicted Accident Probability

An accident probability analysis was conducted using the FRA GradeDec.Net web-based software. GradeDec.Net contains a predicted accident probability module based on the USDOT accident prediction and severity formula. The accident probability analysis found none of the study crossings would have a predicted accident probability above 0.04 accident per year (the benchmark used for the analysis) with project-related construction trains (Table 6.3-7).

Table 6.3-7. 2018 Predicted Accident Probability

	Predicted Accidents (accidents/year)		
		On-Site Alternative Construction	
Crossing	**No-Action Scenario**	**Truck Delivery Scenario**	**Rail Delivery Scenario**
Project Area Access at 38th Avenue	0.008	0.019	0.020
Weyerhaeuser Access at Washington Way	0.014	0.014	0.017
Weyerhaeuser NORPAC Access	0.012	0.012	0.015
Industrial Way	0.013	0.014	0.016
Oregon Way	0.018	0.018	0.021
California Way	0.010	0.010	0.012
3rd Avenue	0.021	0.021	0.025
Dike Road	0.014	0.014	0.014

Operations—Direct Impacts

Vehicle transportation in the project area during operations would not have an adverse impact on vehicle transportation outside the project area. Approximately 135 employees would operate the export terminal in 2028. Operations would occur 24 hours per day, 7 days per week. All vehicles would access the project area via the private driveway opposite 38th Avenue or at the existing driveway on Industrial Way approximately 0.5 mile west of the 38th Avenue driveway. Access roads in the project area would be designed to allow two-way traffic for standard vehicles. All roadways and parking areas would be designed and constructed to the standards appropriate for loading and capacity requirements. All regularly used roads accessing the buildings and facilities in the project area would be sealed with asphalt pavement. Paving would be designed to accommodate mobile equipment loadings. Surfacing of unpaved areas would control soil erosion by wind and water.

Operations—Indirect Impacts

All vehicle transportation impacts during operations would occur outside the project area and, therefore, considered indirect impacts for this analysis. The On-Site Alternative would add 16 trains per day at study crossings along the Reynolds Lead and BNSF Spur. This section presents vehicle delay impacts with current and planned track infrastructure on the Reynolds Lead and BNSF Spur. Planned track infrastructure are estimated to increase the average train speed from:

- 8 miles per hour (mph) to 10 mph at the Weyerhaeuser access crossing opposite Washington Way
- 10 mph to 15 mph at the Weyerhaeuser NORPAC access crossing
- 10 mph to 20 mph at the Industrial Way and Oregon Way crossings
- 8 mph to 15 mph at the California Way and 3rd Avenue crossings.

Planned track infrastructure would not change average train speed at existing site access opposite 38th Avenue and Dike Road crossings. A project-related train would take between 8 and 10 minutes to pass through each public study crossing along the Reynolds Lead with current track infrastructure, and between 4 and 6 minutes with planned track infrastructure. Project-related trains would take about 8 minutes to cross Dike Road along the BNSF Spur. Overall, the 16 project-related trains daily would increase the total gate downtime by over 130 minutes during an average day for the public study crossings along the Reynolds Lead and BNSF Spur.

Vehicle Delay

24-Hour Average Vehicle Delay

The analysis concluded project-related trains would not have an adverse impact on daily average vehicle delay at the public at-grade crossings on the Reynolds Lead and BNSF Spur because average vehicle delay would not change substantially.

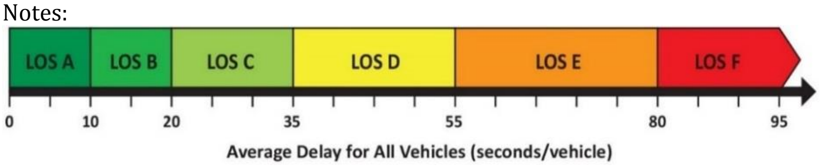
Table 6.3-8 shows the estimated level of service experienced over a 24-hour period at each study crossing along the Reynolds Lead and BNSF Spur in 2028 with current and planned track infrastructure. All public study crossings in 2028 would operate at or better than the standard used for the analysis (level of service D) with current and planned track infrastructure, meaning the average vehicle delay for all vehicles at the public study crossings would be up to 55 seconds. Therefore, project-related trains would not have an adverse impact on average vehicle delay in 2028 at the public study crossings along the Reynolds Lead and BNSF Spur.

One private crossing, the project area access at 38th Avenue, would operate at level of service F with current and planned track infrastructure (the average delay for all vehicles at this crossing would be more than 80 seconds). Project-related trains would have an adverse impact on vehicle delay at this crossing. This crossing currently provides and would continue to provide access to the Applicant’s leased area.

Table 6.3-8. Estimated 24-Hour Average Level of Service at Reynolds Lead and BNSF Lead Study Crossings in 2028 by Scenario[a]

		On-Site Alternative	
Crossing	No-Action	Current Track Infrastructure	Planned Track Infrastructure
Project Area Access at 38th Avenue	A	**F**	**F**
Weyerhaeuser Access at Washington Way	A	C	C
Weyerhaeuser NORPAC Access	A	C	B
Industrial Way	A	C	A
Oregon Way	A	C	A
California Way	A	D	B
3rd Avenue	A	D	B
Dike Road	A	C	C

Notes:



[a] **Bolded, shaded gray** values indicate an adverse impact (a study crossing that operates below level of service D under the On-Site Alternative that would not otherwise operate below level of service D under the No-Action scenario for the same year).

Peak Hour Vehicle Delay

Over a 24-hour period, vehicle delay would be highest during the peak hour. This analysis evaluates the potential impacts during the peak hour as a potential worst-case analysis for vehicle delay during operations. It is unlikely a project-related construction train would travel during the peak hour every day. Vehicle delay at study crossings would be lower than presented in this subsection if project-related trains travel outside of the peak hour (during the other 23 hours of the day). The analysis in the previous subsection represents the 24-hour average vehicle delay for all drivers and is therefore more representative of potential vehicle delay at the study crossings in 2028.

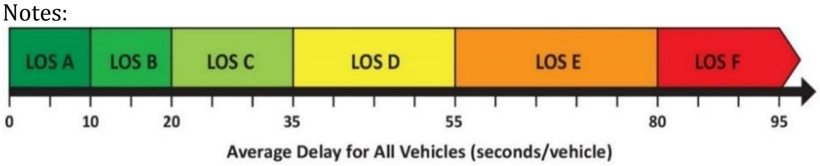
The analysis concluded project-related trains would not have an adverse impact on peak hour vehicle delay at the public at-grade crossings if track improvements are made to the Reynolds Lead and BNSF Spur and one project-related train travels during the peak hour. However, if two project-related trains travel during the peak hour, or infrastructure improvements are not made to the Reynolds Lead and BNSF Spur, vehicle delay would substantially change at selected public at-grade crossings along the Reynolds Lead and BNSF Spur during the peak hour. These vehicle delay impacts would be temporary (limited to the peak hour), and the probability for two trains to pass during the peak hour would be low, as described above. The following presents the results of the peak hour analysis in more detail.

Table 6.3-9 illustrates the estimated peak hour vehicle delay at the study crossings on the Reynolds Lead and BNSF Spur in 2028 by scenario. As shown, the project-related trains would increase average delay per vehicle during the peak hour, with forecasted level of service dropping below D, the standard used for the analysis, at six of the study crossings on the Reynolds Lead with existing track infrastructure.

Table 6.3-9. Estimated Peak Hour Level of Service at Reynolds Lead and BNSF Spur Study Crossings in 2028 by Scenario[a]

		On-Site Alternative		
Crossing	**No-Action**	**Current Track Infrastructure: 1 Peak Hour Train**	**Planned Track Infrastructure: 1 Peak Hour Train**	**Planned Track Infrastructure: 2 Peak Hour Trains**
Project Area Access at 38th Avenue	B	**F**	**F**	**F**
Weyerhaeuser Access at Washington Way	A	**E**	D	**E**
Weyerhaeuser NORPAC Access	A	D	B	C
Industrial Way (SR 432)	A	**E**	B	C
Oregon Way (SR 433)	A	**E**	B	C
California Way	A	**E**	C	D
3rd Avenue	B	**F**	C	**E**
Dike Road	C	D	D	**E**

Notes:



[a] The On-Site Alternative would result in this level of service only if a project-related train travels during the peak hour. **Bolded, shaded gray** values indicate an adverse vehicle delay impact (a study crossing that operates below level of service D under the On-Site Alternative that would not otherwise operate below level of service D under the No-Action scenario for the same year).

Table 6.3-9 illustrates the following.

- If no improvements are made to the Reynolds Lead to increase the average train speed from 10 mph to up to 25 mph and decrease gate downtime at the study crossings, the peak hour level of service would be below level of service D at six of the eight study crossings. This means the average delay for all vehicles at these crossings would be more than 55 seconds during the peak hour. Project-related trains would have an adverse impact at these six crossings only if a project-related train travels through the crossing during the peak hour.
- If improvements are made to the Reynolds Lead, and 1 project-related train travels during the peak hour, one study crossing (project area access at 38th Avenue) would operate below level of service D, meaning the average delay for all vehicles at this crossing would be more than 55 seconds during the peak hour. Project-related trains would only have an adverse impact at this crossing if a project-related train travels through during the peak hour.
- If improvements are made to the Reynolds Lead and 2 project-related trains travel during the peak hour, four of the eight study crossings would operate below level of service D, meaning the average delay for all vehicles at these crossings would be more than 55 seconds during the peak hour. Project-related trains would have an adverse impact at these four crossings only if 2 project-related trains travel through the crossing during the peak hour.

Queuing

Increased vehicle delay from trains blocking at-grade crossings can affect nearby intersections. As vehicles begin to queue while waiting for the crossing to open, increased roadway congestion can affect upstream intersections. Over a 24-hour period, queue lengths would be highest during the peak hour if a project-related train travels through the study crossings during the peak hour. This queuing analysis evaluates the potential impacts if a project-related train travels during the peak hour as a potential worst-case analysis for queue lengths during construction. It is unlikely a project-related train would travel during the peak hour each day. Queue lengths at study crossings would be lower than presented in this subsection if a project-related train does not travel during the peak hour.

Table 6.3-10 illustrates the estimated 2028 peak hour queue length if a project-related train travels during the peak hour. While project-related trains would increase queue lengths at study area crossings, queue lengths would already be exceeded at all of these crossings except the southbound movement at Oregon Way. Table 6.3-10 also illustrates estimated queue lengths with project-related trains would be shorter with planned improvements to the Reynolds Lead because these improvements would allow project-related trains to travel at higher speeds, which would decrease gate downtime at at-grade crossings.

Two queue lengths would exceed the available storage length that would not be exceeded under the 2028 No-Action scenario.

- Vehicles traveling to Weyerhaeuser on Washington Way would queue on Washington Way at the Industrial Way intersection if a project-related train passes during the peak hour. This queue with planned infrastructure to the Reynolds Lead would block the left-turn lane to Industrial Way. The turn lane would not be blocked under the 2028 No-Action scenario. Project-related trains would have an adverse queuing impact at this intersection.
- Vehicles traveling southbound on Oregon Way would queue on Oregon Way if a project-related train passes during the peak hour. The queue would exceed available storage length that would not be exceeded under the 2028 No-Action scenario. Project-related trains would have an adverse queuing impact at this crossing.

Emergency Vehicle Response

The vehicle delay analysis in the previous subsection illustrates how the average vehicle delay for all vehicles, including emergency vehicles, would be affected during operations in 2028. Average vehicle delay would increase with the addition of project-related trains because more trains would operate at study crossings. Because vehicle delay would increase for all vehicles, emergency vehicle delay would also increase if an emergency vehicle is blocked at a crossing occupied by a project-related train.

Table 6.3-10. Estimated Vehicle Queue Lengths—2028 Operations (Peak Hour)[a]

Crossing Name (USDOT Crossing ID)	Road Movement[b]	2028 No-Action – Estimated Queue Length at Crossing (feet)	2028 Exist. Infras. – Estimated Queue Length at Crossing (feet)	2028 Plan. Infras. – Estimated Queue Length at Crossing (feet)	Intersection Affected by Queue from Crossing	Intersection Movement[c]	2028 No-Action – Estimated Queue Length at Intersection (feet)	2028 Exist. Infras. – Estimated Queue Length at Intersection (feet)	2028 Plan. Infras. – Estimated Queue Length at Intersection (feet)
Project Area Access at 38th Avenue	NB	40	1,120	1,240	Industrial Way/ 38th Avenue	WBL	20	160	180
	SB	20	160	200		EBR	20	20	20
Weyerhaeuser Access at Washington Way	NB	280	760	480	Industrial Way/ Washington Way	WBL	120	180	140
						EBR	40	40	40
	SB	120	240	200		SBT	60	240	180
Weyerhaeuser NORPAC Access	NB	60	160	100	Industrial Way/ NORPAC Access	WBL	20	20	20
	SB	20	20	20		EBR	20	20	20
Industrial Way	NB	380	500	420	Industrial Way/ Weyerhaeuser	EBL	140	200	120
	SB	340	1,200	520		NBT	260	380	300
Oregon Way	NB	880	2,140	1,460	Industrial Way/ Oregon Way	NBT	660	1,920	1,220
						EBL	180	240	200
						WBR	100	100	100
	SB	440	1,580	800	Oregon Way/ Alabama Street	EBR	N/A	280	120
						WBL		560	100
						SBT		880	100
California Way	NB	100	240	180	Industrial Way/ California Way	N/A	N/A	N/A	N/A
	SB	160	660	380					
3rd Avenue	NB	1,400	1,720	600	3rd Avenue/ Industrial Way	WBR	60	120	80
						NBT	1,000	1,320	200
					Industrial Way/ California Way	SBL	120	120	N/A
	SB	340	1,740	820		NBR	80	80	
						EBT	760	1,080	

Crossing Name (USDOT Crossing ID)	Road Movement[b]	2028 No-Action	2028 Exist. Infras.	2028 Plan. Infras.	Intersection Affected by Queue from Crossing	Intersection Movement[c]	2028 No-Action	2028 Exist. Infras.	2028 Plan. Infras.
		Estimated Queue Length at Crossing (feet)					Estimated Queue Length at Intersection (feet)		
Dike Road	NB	60	80	100	None	N/A	N/A	N/A	N/A
	SB	100	120	140					
	WB	80	80	80					

Notes:

[a] Shaded gray values indicate a study crossing or intersection with a queue that exceeds available storage for the scenario. Shaded black values indicate an adverse queuing impact.

[b] MVMT= Roadway movement approaching the rail crossing; NB = northbound; SB = southbound; EB = eastbound; WB = westbound

[c] MVMT= Movement at nearby intersection affected by queue from rail crossing; NBL = northbound left; NBR = northbound right; NBT = northbound through; SBL = southbound left; SBR = southbound right; SBT = southbound through; EBL = eastbound left; EBR = eastbound right; EBT = eastbound through; WBL = westbound left; WBR = westbound right; WBT = westbound through; N/A = data not available

Project-related trains would increase total gate downtime over 130 minutes during an average day at public study crossings along the Reynolds Lead and BNSF Spur without track improvements. In a 24-hour period, project-related trains would increase the probability of emergency response vehicles being delayed by the following:

- 10% at study crossings along the Reynolds Lead and BNSF Spur with existing track infrastructure
- 5% at study crossings along the Reynolds Lead and BNSF Spur with planned track infrastructure

The impact on emergency vehicle response would depend on the location of the origin and destination of the response incident in relation to the at-grade crossings along the Reynolds Lead and BNSF Spur. The potential for project-related trains to affect emergency response would also depend on whether the dispatched emergency vehicle would need to cross the rail line and the availability of alternative routes if a project-related train occupies the crossing at the time of the call.

Predicted Accident Probability

An accident probability analysis was conducted using the FRA GradeDec.Net web-based software. GradeDec.Net contains a predicted accident probability module based on the USDOT accident prediction and severity formula.

The predicted accident probability with existing crossing safety protection at the 3rd Avenue (SR 432) study crossing along the Reynolds Lead would be 0.026 accident per year under the No-Action Alternative, and 0.042 accident per year under the On-Site Alternative (Table 6.3-11). Project-related trains would result in an adverse vehicle safety impact at the 3rd Avenue crossing.

Table 6.3-11. 2028 Predicted Accident Probability

Crossing	Predicted Accidents (accidents/year)	
	No-Action Scenario	2028 Proposed Export Terminal Scenario
Project Area Access at 38th Avenue	0.011	0.035
Weyerhaeuser Access at Washington Way	0.018	0.027
Weyerhaeuser NORPAC Access	0.016	0.031
Industrial Way	0.016	0.025
Oregon Way	0.022	0.038
California Way	0.012	0.020
3rd Avenue	0.026	0.042
Dike Road	0.014	0.020

6.3.5.2 Off-Site Alternative

This section describes the potential impacts of construction and operation of the proposed export terminal at the Off-Site Alternative location.

Construction—Direct Impacts

Construction of the proposed export terminal the Off-Site Alternative location would generate the same number of vehicle trips as the On-Site Alternative. Direct impacts during construction would be the same as described for the On-Site Alternative, except construction vehicles would access the project area for the Off-Site Alternative via a new private driveway on Mt. Solo Road.

Construction—Indirect Impacts

Construction of the proposed export terminal at the Off-Site Alternative location would result in the following indirect impacts.

Vehicle Delay

Average vehicle delay, peak hour vehicle delay, and queuing at study crossings would be the same as the On-Site Alternative at all study crossings, except at the crossing of the Reynolds Lead at 38th Avenue. Average vehicle delay, peak hour vehicle delay, and queuing at this study crossing and queue lengths at the Industrial Way/38th Avenue intersection would be less than the On-Site Alternative because construction vehicles associated with the terminal would not use this crossing under the Off-Site Alternative.

Under the Off-Site Alternative, it is anticipated the driveway on Mt. Solo Road that provides access to the Off-Site Alternative project area would be controlled with a stop sign. Mt. Solo Road would continue to be free-flow and would not introduce a new stop sign or intersection signal at the project area access driveway that would substantially slow operations on Mt. Solo Road. Under the truck delivery scenario, trucks entering and exiting the project area access driveway could slow traffic on Mt. Solo Road but would not be expected to substantially change vehicle operations on Mt. Solo Road. The turning movements of trucks to and from Mt. Solo Road would decrease vehicle safety conditions and increase the potential for a crash compared to the No-Action Alternative because a new access point with truck turning movements would be introduced on Mt. Solo Road.

The driveway would cross the rail loop in the project area more than 3,000 feet from Mt. Solo Road. Therefore, vehicle queueing at this at-grade crossing in the project area would not affect vehicle operations on Mt. Solo Road.

Emergency Vehicle Response

This impact would be the same as described for the On-Site Alternative.

Predicted Accident Probability

This impact would be the same as described for the On-Site Alternative.

Operations—Direct Impacts

The Off-Site Alternative would generate the same number of vehicle trips as the On-Site Alternative during operations. Direct impacts during operations would be the same as the On-Site Alternative, except vehicles would access the project area for the Off-Site Alternative via a new private driveway on Mt. Solo Road.

Operations—Indirect Impacts

Construction of the Off-Site Alternative would result in the following indirect impacts on vehicle transportation.

Vehicle Delay

Average vehicle delay, peak hour vehicle delay, and queuing at study crossings would be the same as the On-Site Alternative at all study crossings, except at the crossing of the Reynolds Lead at 38th Avenue. Average vehicle delay, peak hour vehicle delay, and queuing at this study crossing and queue lengths at the Industrial Way/38th Avenue intersection would be less than the On-Site Alternative because vehicles associated with the terminal operations would not use this crossing under the Off-Site Alternative.

Under the Off-Site Alternative, it is anticipated the driveway on Mt. Solo Road that provides access to the Off-Site Alternative project area would be controlled with a stop sign. Mt. Solo Road would continue to be free-flow (not controlled by a stop sign or intersection signal). Therefore, vehicle trips to and from the project area would not substantially change vehicle operations on Mt. Solo Road. Vehicle turning movements to and from Mt. Solo Road would decrease vehicle safety conditions and increase the potential for a crash compared to the No-Action Alternative because a new access point with turning movements would be introduced on Mt. Solo Road.

The private driveway would cross the rail loop in the project area more than 3,000 feet from Mt. Solo Road. Therefore, vehicle queueing at this crossing in the project area would not affect vehicle operations on Mt. Solo Road.

Emergency Vehicle Response

This impact would be the same as described for the On-Site Alternative.

Predicted Accident Probability

This impact would be the same as described for the On-Site Alternative.

6.3.5.3 No-Action Alternative

Under the No-Action Alternative the Corps would not issue a Department of the Army permit authorizing construction and operation of the proposed export terminal. As a result, impacts resulting from constructing and operating the export terminal would not occur. In addition, not constructing the export terminal would likely lead to expansion of the adjacent bulk product business onto the On-Site Alternative project area. The following discussion assesses the likely consequences of the No-Action Alternative regarding vehicle transportation.

Vehicle transportation conditions in 2018 would be as follows.

- **24-hour average vehicle delay.** All study crossings would continue to operate at level of service A (Table 6.3-4).
- **Peak hour vehicle delay.** All study crossings would operate level of service C or better (Table 6.3-5).
- **Vehicle queuing.** Vehicle queues extending from six study crossings (all along the Reynolds Lead) would affect seven nearby intersections (Table 6.3-6). Vehicle queues at these intersections would exceed the available storage length at four approaches during the peak hour. These queues could potentially block other movements at these intersections and affect vehicle delay. No study crossings would exceed available storage length on the BNSF Spur.
- **Vehicle safety.** The No-Action Alternative would not have an adverse impact on vehicle safety because the predicted accident probability was found to be below the benchmark used for the analysis (Table 6.3-7).

A limited-scale future expansion scenario proposed by the Applicant was evaluated, as described in Chapter 3, *Alternatives*. Under this scenario, approximately 2 trains per day would use the Reynolds Lead and BNSF Spur. The following provides a summary of vehicle transportation conditions in 2028 for this scenario.

- **24-hour average vehicle delay.** All study crossings would operate at level of service A (Table 6.3-8).
- **Peak hour vehicle delay.** Study crossings on the Reynolds Lead and BNSF Spur would operate at level of service C or above (Table 6.3-9).
- **Vehicle queuing.** Vehicle queues extending from seven study crossings (six along the Reynolds Lead) would affect eight nearby intersections during the peak hour (Table 6.3-10). Vehicle queues at these intersections would exceed the available storage length at four approaches and affect vehicle delay. These queues could potentially block other movements at these intersections.
- **Vehicle safety.** The No-Action Alternative would not have an adverse impact on vehicle safety because the predicted accident probability was found to be below the benchmark used for the analysis (Table 6.3-11).

6.3.6 Required Permits

No permits related to vehicle transportation would be required for the proposed export terminal.

6.4 Vessel Transportation

This section describes vessel transportation and safety in the study area, and potential impacts on vessel transportation from construction and operation of the proposed export terminal.

6.4.1 Regulatory Setting

Conventions, regulations, statutes, and guidelines relevant to vessel transportation are summarized in Table 6.4-1.

Table 6.4-1. Conventions, Regulations, Statutes, and Guidelines for Vessel Transportation

Convention, Regulation, Statute, Guideline	Description
International	
International Convention for the Safety of Life at Seas	Required safety standards for international ships for construction, navigation, life-saving, communications, and fire equipment. Also referred to as SOLAS.
International Convention for the Prevention of Pollution from Ships (MARPOL 73/78)	International convention covering prevention of pollution of the marine environment by ships from operational or accidental causes.
International Ship and Port Facility Security Code	Security-related requirements for governments, port authorities, and shipping companies.
International Maritime Solid Bulk Cargoes Code	Procedures for bulk cargo carriers.
International Regulations for Preventing Collisions at Sea, 1972	Rules on safe navigation for vessels in international waters. Also referred to as 72 COLREGS.
Standards of Training, Certification, and Watchkeeping 1978 revised in 1995 and 2010	Standards for training, certification, and watchkeeping requirements for seafarers.
Federal	
Inland Navigational Rules Act of 1980 (Public Law 96-591) known as “Rules of the Road” (33 CFR 84-90)	Navigation rules for U.S. waters.
46 USC (Shipping) Chapter 33 (Inspection)	Consolidates the laws governing the inspection and certification of vessels by the U.S. Coast Guard.
Ports and Waterways Safety Act of 1972 (33 USC 1221 et seq.)	Provides for the protection and “safe use” of a U.S. port (includes the marine environment, the navigation channel, and structures in, on, or immediately adjacent to the navigable waters) and for the protection against the degradation of the marine environment.
Maritime Transportation Security Act of 2002 (46 USC 701). Relevant regulations are 33 CFR 101 and 105.	Requirements for maritime security.

Convention, Regulation, Statute, Guideline	Description
Maritime Transportation Act of 2004. Amended 311(a) and (j) of the Federal Water Pollution Control Act. Relevant regulations are 33 CFR 151, 155, and 160.	Requires cargo vessel owners or operators to prepare and submit oil discharge response plans.
Federal Water Pollution Control Act, as amended by Section 4202 of the Oil and Pollution Act of 1990 (33 USC 1321). Relevant regulations are the National Oil and Hazardous Substances Pollution Contingency Plan (40 CFR 300) and 33 CFR 155.5010–5075.	Requires non-tank vessels to prepare and submit oil or hazardous substance discharge response plans when operating on the navigable waters of the United States.
The Act to Prevent Pollution from Ships (33 USC 1901 et. seq.)	Implementing U.S. legislation for MARPOL and Annexes I and II.
Maritime Transportation Act of 2004; and the Coast Guard and Maritime Transportation Act of 2006	Requires cargo vessel owners or operators to prepare and submit oil or hazardous substance discharge response plans.
33 CFR 80-82	International Navigation Rules
33 CFR, 46 CFR, and 49 CFR	These regulations incorporate international laws to which the United States is signatory as well as various classification society and industry technical standards governing the inspection, control, and pollution prevention requirements for vessels.
Washington State	
Washington State Bunkering Operations (WAC 317-40) (RCW 88.46.170)	Establishes minimum standards for safe bunkering (transfer of fuel to a vessel) operations.
Washington State Oil Spill Contingency Plan Requirements (WAC 173-182) (RCW 88.46, 90.56, and 90.48)	Requires cargo vessels 300 or more gross tons be covered by a contingency plan for the containment and cleanup of oil.
Washington State Vessel Oil Transfer Advance Notice and Containment Requirements (WAC 173-184)	Requires facility or vessel operators who transfer oil to provide the state with a 24-hour advance notice of transfer.
Washington State Cargo Vessel Boarding and Inspection (WAC 317-31)	Cargo vessels 300 or more gross tons shall submit a notice of entry at least 24 hours before the vessel enters state waters and be subject to boarding and inspection by state inspectors to ensure compliance with accepted industry standards.
Oregon State	
OAR 856-010-0003 through 0060 and 856-030-0000 through 0045 (Statutory Authority: ORS Title 58 Chapter 776).	Oregon State Board of Maritime Pilots Rules for pilotage of vessels in Oregon state waters, including the Columbia River.
Local	
There are no local laws and regulations relevant to vessel transportation.	

Notes:
SOLAS = International Convention for the Safety of Life at Seas; COLREGS = International Regulations for Proventing Collisions at Sea; MARPOL = International Convention for the Prevention of Pollution from Ship; STCW = Standards of Training, Certification, and Watchkeeping; USC = United States Code; CFR = Code of Federal Regulations; WAC = Washington Administrative Code; OAR = Oregon Administrative Rule; ORS = Oregon Revised Statute

6.4.2 Study Area

The study areas for vessel transportation are the same for both the On-Site Alternative and Off-Site Alternative. The study area for direct impacts is the area surrounding the proposed docks where vessel maneuvering and loading would occur. The study area for indirect impacts includes the waterways used by, or that could be affected by vessels calling at the project areas. It includes the lower Columbia River from the mouth of the river upstream to Vancouver, Washington,[1] and the Willamette River upriver to the Port of Portland. These study areas are consistent with the Corps' NEPA scope of analysis Memorandum for Record (February 14, 2014), adjusted to reflect specific conditions near the project areas.

6.4.3 Methods

This section describes the sources of information and methods used to evaluate the potential impacts of construction and operation of the proposed export terminal.

6.4.3.1 Information Sources

The following sources of information were used to identify the potential impacts of the terminal on vessel transportation in the study areas. Information for the vessel traffic analysis was also obtained from stakeholder interviews.

- Detailed vessel traffic data from the Columbia River Bar Pilots (Bar Pilots) included in information provided by the Applicant (URS Corporation 2014) was validated during a meeting with the Bar Pilots. This information and other data obtained from the pilots are the basis for historical vessel traffic type and volumes. Washington State Department of Ecology (Ecology) Vessel Entries and Transits (VEAT) data were used for comparison with the Bar Pilot data.
- The Columbia River Pilots (River Pilots) representatives provided information on vessel traffic management within the Columbia River and vessel docking issues for the existing dock (Dock 1) at the project area for the On-Site Alternative.
- Merchants Exchange of Portland, Oregon (PDXMEX), provided Automatic Identification System (AIS) data and a synopsis of its operations.
- Port of Portland provided information on the LOADMAX channel reporting and forecasting system.
- *Coast Pilot 7 (Pacific Coast: California, Oregon, Washington, Hawaii, and Pacific Islands)* (National Oceanic and Atmospheric Administration 2014) and the *Lower Columbia Region Harbor Safety Plan* (Lower Columbia Region Harbor Safety Committee 2013) provided information on the vessel transportation characteristics of the study area.

The following data were used as part of the risk analysis.

- AIS data to establish baseline (2014) vessel types, sizes, routes, and transit frequencies between the Columbia River mouth and Longview.

[1] For purposes of this EIS, the lower Columbia River ends at the landward limit of the Territorial Sea, which is a line drawn between the seaward tips of the North Jetty and South Jetty. The Port of Vancouver is the furthest upriver port receiving large commercial vessels.

- Historical data on vessel incidents and severity, based on the U.S. Coast Guard (USCG) Marine Information for Safety and Law Enforcement (MISLE) database for 2001 to 2014.
- Data on reported oil spills within the Columbia and Willamette Rivers from the following three databases for the period between January 1, 2004, and December 31, 2014[2]: USCG MISLE database, Ecology's Environmental Report Tracking System (ERTS) database, which records all incidents reported to the state, and Ecology's Spills Program Incident Information (SPIIS) database, which records spills reported to the state.

6.4.3.2 Impact Analysis

The following methods were used to evaluate the potential impacts of the On-Site Alternative, Off-Site Alternative, and No-Action Alternative on vessel transportation.

- The vessel transportation route, navigational considerations, historical and current vessel traffic patterns, and the systems in place to monitor and control vessel traffic along the route were described based on information gathered through the sources described in Section 6.4.3.1, *Information Sources*.
- Construction-related impacts were qualitatively assessed based on the relative increase in activity in and around the project areas and the potential to disturb ongoing vessel transportation.
- Operations-related impacts at the project areas (direct impacts) were qualitatively evaluated in terms of the increased potential for vessel-related incidents to occur.
- Operations-related impacts during vessel transit (indirect impacts) were evaluated both qualitatively and quantitatively to determine the potential for increased risks. Historical vessel incident data were evaluated to characterize the nature and magnitude of vessel incidents on the Columbia River to the project areas. This information was used to provide context for interpreting operational impacts.
- The potential for vessel incidents (i.e., allisions,[3] collisions, groundings, and fire/explosions by project-related vessels during transit) was modeled for existing conditions, the On-Site Alternative, Off-Site Alternative, and No-Action Alternative. The potential for allisions during transit was qualitatively assessed.
  - The incident frequencies were estimated using the Marine Accident Risk Calculation System (MARCS) model and were limited to the area evaluated in the study (DNV GL 2016).
  - The number of trips for non-project-related vessels were derived from 2014 AIS data for all vessel types. An increase of 1% per year was applied to the 2014 AIS data through 2028 for the No-Action Alternative. The number of vessels with the proposed export terminal was added to this total to determine the incremental increase in the likelihood of the modeled incidents occurring.
- To provide context for understanding the relative consequences of a collision, grounding or allision incident, a survey of USCG Marine Information for Safety and Law Enforcement (MISLE)

[2] When the information from these three datasets were combined all duplicate entries were removed and only incidents with actual reported spills of petroleum or petroleum products were considered in the development of the baseline oil spill frequency for the study area.

[3] An allision occurs when a vessel strikes a fixed structure, such as a dock or a vessel at berth.

database was conducted for years 2001 to 2014. This period was chosen because it covers over 99% of all reported collision, grounding, and allision incidents in the dataset. Data surveys were conducted for the national dataset and for the study area separately to test for differences in the distribution of incident severity between the two.

- Increased risks of bunker oil spills were addressed quantitatively and qualitatively.
  - The potential for a bunker oil spill to occur as the result of an incident was modeled using the Naval Architecture Package (NAPA model) (DNV GL 2016). The model estimates oil outflow volumes based on the number of damaged cargo tanks and interaction with tidal influences.
  - The potential for releases to occur during bunkering was qualitatively assessed based on the relative increase in vessel traffic.

6.4.4 Affected Environment

This section addresses the environment in the study areas. The analysis includes the natural and built environment, types and volumes of vessel traffic, vessel traffic management, vessel incident frequency and severity, and incident management and response systems.

6.4.4.1 Natural and Built Environment

This section describes the marine environment and facilities and other physical features relevant to marine navigation in the study area. Figure 6.4-1 illustrates the location of the features discussed in this section.

Marine Environment

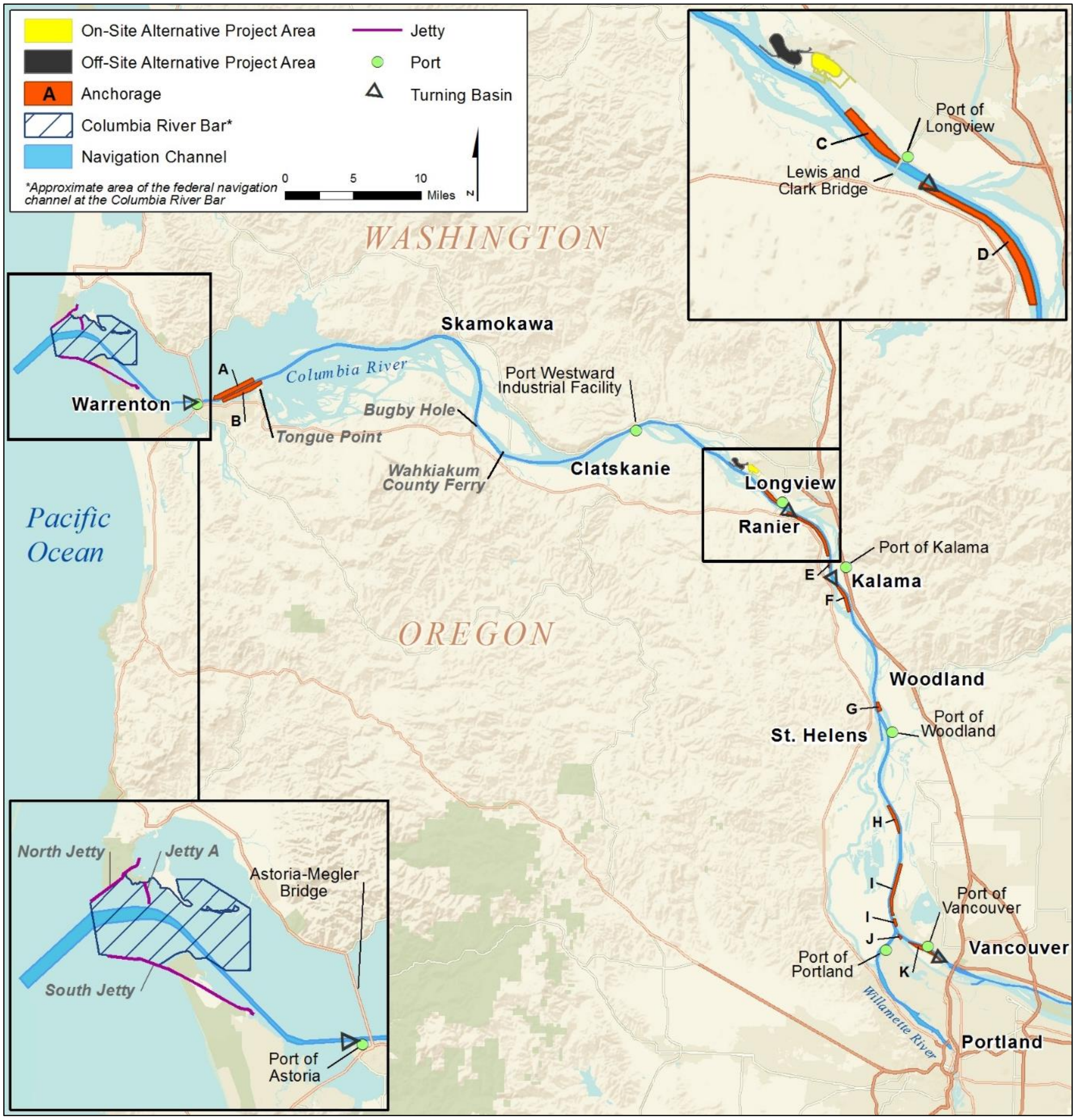
Conditions in the Pacific Ocean near the mouth of the Columbia River can vary greatly depending on the time of year. Prevailing winds and seasonal patterns have the greatest effect on offshore conditions. Longshore currents that generally flow to the north in winter and to the south in summer also affect vessel navigation, although not as much as tidal current and river flows.

Although winds are strongest in late fall and winter, they seldom reach gale force along the Columbia River. The strongest winds are usually out of the south or southwest. Wind flow is generally from the east through southeast in winter. Spring and summer typically have northwest and west wind patterns and can clash with river outflows. The volume of water flowing from the Columbia River and the force of impact with ocean conditions can combine to create daunting sea conditions. Fog is a hazard during late summer and fall.

Columbia River Bar

The Columbia River Bar is seaward of the mouth of the Columbia River (Figure 6.4-1). The bar is about 3 miles wide and 6 miles long. The bar is where the energy of the river's current dissipates into the Pacific Ocean, often as large standing waves (1 meter/3.28 feet or more) (Jordan pers. comm. B). The waves result from the bottom contours of the bar area as well as the mixing of fresh and saltwater and environmental conditions.

Figure 6.4-1. Ports, Anchorages, and other Features in the Study Area



Note: Letters correspond to anchorages described in Table 6.4-3.

Tide, current, swell, and wind—direction and velocity—all affect the bar conditions. There are two full tidal current ebb and flood cycles each day, and conditions at the bar can change drastically in a very short time period with the tidal flow. Worst-case conditions typically occur when onshore winds and tidal ebb combine with the river flow; when this happens, the effects can change unpredictably in a very short time as the tidal flow cycles (National Oceanic and Atmospheric Administration 2014).

Columbia River

The tidal range at the mouth of the Columbia River is approximately 5.6 feet with mean higher high water measured at 7.5 feet in 2013 (National Oceanic and Atmospheric Administration 2014). At Portland and Vancouver the tidal range is approximately 2.3 feet with mean higher high water measured at 8.7 feet in 2013 (NOAA tides and water levels station 9440083). Typically tidal influence reaches as far as the Portland/Vancouver area. However, tidal effects can be felt to as far as 140 miles upriver under low-flow conditions (National Oceanic and Atmospheric Administration 2015).

Navigation Channel

The Oregon–Washington border follows the Columbia River (Figure 6.4-1). The navigation channel in the study area includes two U.S. Army Corps of Engineers (Corps) projects: the Columbia and Lower Willamette River Project and the Mouth of the Columbia River Project. The navigation channel is described by the three following areas.

- **Mouth of the Columbia River.** The portion of the channel at the mouth of the Columbia River, referred to as the Columbia River Bar, is 6 miles long, extending 3 nautical miles[4] into the Pacific Ocean from the mouth of the river to 3 miles upriver. This segment of the channel varies from 2,000 feet wide and 55 feet deep to 640 feet wide and 48 feet deep. Waters in this area are considered treacherous and large vessels require a licensed pilot.[5] The Corps maintains three jetties at the mouth of the Columbia River (Figure 6.4-1) to help keep the channel at the mouth of the river clear.
- **Columbia River.** From the upriver extent of the bar (river mile 3) to Vancouver (river mile 106.5), the channel is generally maintained to a depth 43 feet and a width of 600 feet (U.S. Army Corps of Engineers 2015a).[6]
- **Willamette River.** Along the lower 11.6 miles of the Willamette River, the channel has a depth of 40 feet.

Traffic in the channel moves in a two-way pattern: one lane inbound and one lane outbound. Although some areas of the navigation channel are dredged into rock, the channel sides consist primarily of loose, unconsolidated sediment.

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[4] Offshore distances are recorded in terms of nautical miles and inshore distances and river distances are given in terms of statute miles.

[5] Oregon Administrative Rule 856-010-0060 exempts the following vessels from compulsory pilotage on the Columbia River Bar: (a) Foreign fishing vessels not more than 100 feet or 250 gross tons international; (b) Recreational vessels not more than 100 feet long.

[6] Near Vancouver, depth varies between 35 and 43 feet and width varies between 400 and 500 feet.

Ports

Table 6.4-2 lists the ports in the study area with berthing for large vessels along with their locations and facilities. Figure 6.4-1 shows the locations of these ports.

Table 6.4-2. Port Facilities in the Study Area

Port	Location	Facilities
Port of Astoria, OR	RM 12	Three deep-draft berths; additional berths for small commercial fishing vessels and research vessels; two marinas and a boatyard; two anchorages
Port of St. Helens, Port Westward Industrial Facility, near Clatskanie, OR	RM 53	Port Westward Industrial facility. One dock and one deep-water berth
Port of Longview, WA	RM 65	Eight marine terminals containing a total of eight berths
Port of Kalama, WA	RM 75	Seven marine terminals: two grain elevators, one general cargo dock, one barge dock, one liquid bulk facility, one lumber barge berth, and one deep-draft wharf
Port of Portland, OR	RM 100	Four marine terminals containing a total of 18 berths
Port of Vancouver, WA	RM 106.5	Four marine terminals containing a total of 13 berths

Notes:
RM = river mile

Anchorages and Turning Basins

Vessels anchor within the Columbia River system for a variety of reasons, planned (e.g., to take on fuel, to wait for a berth) or unplanned (e.g., mechanical repairs, to wait for better weather conditions). In anticipation of this need, USCG has designated 11 locations for vessels to anchor (Table 6.4-3). Each location has specific characteristics with which vessel masters, crews, and pilots must be familiar. Corps regulations establish the operational rules for the anchorages, including a requirement that vessels desiring to anchor must contact the pilot office managing the anchorage to request a position assignment. The Bar Pilots manage Astoria North and Astoria South anchorages. The River Pilots manage the anchorages upriver from Astoria.

Bunkering[7] operations are normally permitted in all anchorages. The Lower Vancouver and Upper Vancouver anchorages are the only anchorage areas maintained by the Corps as part of the Columbia River navigation channel. The other designated anchorages are at sites identified as naturally deep locations, although shoaling does occur to some extent and dredging is occasionally necessary.

Four turning basins are located in the study area (Figure 6.4-1). Turning basins are generally wider areas along a channel dredged to the same depth as the channel where vessel masters and pilots have maneuvering room to turn vessels for the purposes of pointing the bow of the vessel in the direction of transit. Only the Longview turning basin, which is located at river mile 66.5 and encompasses the proposed berths at the project area for the On-Site Alternative, can accommodate Panamax-sized vessels.

[7] The transfer of fuel onto a vessel.

Table 6.4-3. Anchorages in the Study Area

ID[a]	Anchorage Name	River Miles	Range of Depth(s) (feet)	Maximum Vessel Size	Vessel Capacity
A	Astoria North[b]	14–17.8	24–45+	Panamax	6
B	Astoria South	15–18.2	20–45+	Handymax	4
C	Longview	64–66	29–40+	Handymax	5
D	Cottonwood Island	66.7–71.2	19–40+	Handymax	13
E	Prescott	72.1–72.5	52–65+	Panamax	1
F	Kalama	73.2–76.2	26–40+	Panamax	7
G	Woodland[c]	83.6–84.3	8–40+	<600 feet LOA	3
H	Henrici Bar[c]	91.6–93.9	22–33+	<600 feet LOA	8
I	Lower Vancouver	96.2–101.0	50+	<600 feet LOA	14
J	Kelly Point	101.6–102.0	25–40+	Panamax	1
K	Upper Vancouver	102.6–105.2	35–50+	Panamax or larger	7

Notes:
[a] Identification letter corresponds to letters in Figure 6.4-1.
[b] This anchorage is generally reserved for large and deeply laden vessels as determined by Columbia River Pilots.
[c] Remote and not currently in use.
Source: Lower Columbia Region Harbor Safety Committee 2013 and U.S. Army Corps of Engineers 2015
LOA = length overall

Bridges

Two bridges cross the navigation channel at and downriver of the project areas (Figure 6.4-1).

- Lewis and Clark Bridge crosses the Columbia River between Longview, Washington, and Rainier, Oregon. It has a vertical clearance of 187 feet and a horizontal clearance of 1,120 feet. This bridge is upriver from the project areas, and project-related vessels would not pass through this bridge under normal operations.
- Astoria-Megler Bridge crosses the Columbia River between Astoria, Oregon, just inland of the Port of Astoria, and Point Ellice, near Megler, Washington. It has a vertical clearance of 205 feet and a horizontal clearance of 1,070 feet.

Ferries

One ferry, the Wahkiakum County Ferry, crosses the navigation channel on the Columbia River between Puget Island, Washington and Westport, Oregon, at river mile 37.4 (Figure 6.4-1). It is the only ferry crossing downriver of the project areas.

6.4.4.2 Vessel Traffic

Vessels transiting the lower Columbia River include commercial cargo, fishing, and passenger vessels; recreational vessels; and service vessels (including tugs, pilot boats, and USCG vessels), as well as a small number of other vessels such as military ships, research vessels, and industrial construction vessels. The cargo vessels and large passenger vessels (cruise ships) are generally restricted to the navigation channel and maintain a predictable two-way traffic pattern (one lane inbound and one lane outbound). For the purposes of this EIS, cargo vessels (ships and barges) and cruise ships are referred to as *large commercial vessels*. The other vessels are generally not restricted to movement in the navigation channel. For the most part, these vessels are more agile and less predictable in their movements. Data sources and availability regarding these two broad categories of vessels differ. For these reasons, the following discussion of vessel traffic has been separated into two sections: *Large Commercial Vessels* and *Other Vessels*.

Large Commercial Vessels

This section focuses on large commercial vessels calling at ports in the study area. Cargo vessels comprise over 99% of large commercial vessels and include ships and barges carrying various cargo including dry bulk, automobiles, containers, bulk liquids, and other general cargo.[8] Large commercial vessels comprise most deep-draft vessel traffic in the study area.[9] Cargo ships are categorized[10] by their capacity and dimensions. The vessel classes accommodated in the study area are listed in Table 6.4-4 with their typical dimensions and cargo capacities.

Table 6.4-4. Vessel Classes in Use on the Columbia River Navigation Channel

Vessel Class	Deadweight (tons)	Length (feet)	Beam (feet)	Design Draft (feet)
Handymax	10,000–49,999	490–655	75–105	36–39
Panamax	50,000–79,999	965	106	39.5
Post-Panamax[a]	Over 80,000	965 or greater	106 or greater	39.5 or greater

Notes:
[a] The Post-Panamax class, also referred to as New Panamax, is a new vessel class for the expanded Panama Canal dimensions.
Source: INTERCARGO 2015

Cargo Types and Tonnages

Table 6.4-5 presents the types and amounts of cargo transported along the Columbia River. The amounts and percentages in the table reflect average annual gross tonnage for the period 2004 to 2014, based on Bar Pilots' data (Jordan pers. comm. A). The primary growth areas in recent years have been in the dry bulk and automobile traffic.

[8] Cruise ships comprise less than 1% of large commercial vessel traffic in the study area. *Historical Traffic Volumes* provides a detailed discussion of vessel traffic by vessel type over a recent 11-year period.
[9] A small number of deep-draft military ships and research vessels also transit the study area.
[10] These category names often reflect the canal through which the vessels are designed to travel.

Table 6.4-5. Cargo Types and Corresponding Average Annual Gross Tonnage (2004–2014)

Cargo Type	Gross Tonnage	Percentage[a] of Total Cargo Moved
Dry bulk	44,551,063	47.3
Automobiles	20,986,525	22.3
Containers	11,187,455	11.9
General cargo	7,447,913	7.9
Bulk liquid	4,127,333	4.4
Other[b]	5,912,903	6.3
Total	**94,213,193**[c]	**100.0**

Notes:

[a] Percentages refer to gross tonnage to better represent the approximate quantities of various commodities moved along the Columbia River.

[b] Miscellaneous gross tonnage accounting for vessel movements from one berth to another, passenger vessels, tugs, and empty barge movements.

[c] Numbers do not sum due to rounding.

Source: Bar Pilots data (Jordan pers. comm. A).

Tug Assistance

Cargo and cruise ships require tugs (generally a minimum of two) to provide assistance during docking and undocking, because these vessels lack adequate maneuverability at slower speeds. These vessels also may rely on tugs in emergency situations to assist, escort, and in some cases, provide fire suppression. Tug escorts on the Columbia River are generally engaged only in unusual conditions (e.g., electronic equipment issue that would prevent safe navigation or inoperable vessel propulsion system at normal power levels) that can be mitigated by the tug escort.

Vessel Speed and Travel Times

The vessels discussed in this section are primarily restricted to the navigation channel, in which traffic moves in two lanes: one lane inbound and one lane outbound. Their speeds generally range between 9 and 15 knots, with the slower speeds occurring while passing port areas; still slower speeds of between 6 and 9 knots occur while passing through anchorages (DNV GL 2016).

Travel time across the bar takes approximately 2 hours in either direction. Travel time from the east end of the bar to Longview is approximately 5 hours inbound (generally vessels in ballast[11]) and about 6 hours outbound (generally loaded vessels). Outbound transits generally take longer than inbound transits for two reasons: the majority of outbound vessels are loaded and, therefore, travel at reduced speeds and outbound transits are scheduled during high-tide conditions to maximize under-keel clearance[12] and thus usually are running against the force of a flood (incoming) tide.

[11] Vessels *in ballast* are not loaded with cargo, but have had their tanks loaded with seawater to increase vessel stability; these vessels have less of a draft than when loaded.

[12] *Under-keel clearance* is the amount of space between the hull of the vessel and the bottom of the channel.

Existing Vessel Traffic and Distribution

Figure 6.4-2 depicts activity by vessel type at eight locations (Figure 6.4-3) on the lower Columbia River based on 2014 AIS data (DNV GL 2016). The categories shown in Figure 6.4-2 that apply to large commercial vessels are Cargo Ships, Passenger (cruise ships and other large commercial passenger vessels), and, Tug/Tug with Barge.[13] As shown in the figure, vessel activity is greatest near the mouth of the Columbia River. Much of this increased activity is related to service and fishing vessel activity. Cargo ship activity is fairly consistent between Longview and the mouth of the river.

Existing Port Activity

Characterizing existing port activity is another way to understand large commercial vessel activity. Types and uses of vessels calling at ports in the study area (Figure 6.4-1) are described below.

- Port of Astoria primarily receives cruise ships, loggers and other cargo vessels, and other types of vessels (e.g., USCG, pollution control, commercial fishing, and recreational vessels). The port reports approximately 230 vessel calls [14] at the Waterfront and Tongue Point berths in 2015 (McGrath pers. comm.).
- Port of St. Helens, Port Westward Industrial Facility receives tankers and tank barges.
- Port of Longview receives cargo ships and barges transporting various types of general and bulk cargo, including steel, lumber, logs, grain, minerals, alumina, fertilizers, pulp, paper, wind energy components, and heavy-lift cargo. The port reported 222 vessel calls in 2015 with a 5-year average of 205 vessel calls per year (Hendriksen pers. comm.).
- Port of Kalama receives cargo ships and barges primarily transporting grain, but also liquid bulk chemicals and general cargo. The Port reported 205 vessel calls in 2014 (Port of Kalama 2015).

[13] Because barges do not have AIS receivers, barge numbers are captured as part of the tug data. The tug numbers include tugs traveling independently and tugs towing or pushing barges. Only the latter are considered large commercial vessels. The number of tug and barge units (cargo barges), including ATBs, entering and exiting the river are best represented by transits recorded for the Ilwaco locations; the increased tug activity in the upriver portions of the study area, especially near Longview and Wauna, likely represents tugs traveling independently to provide docking services and tugs shifting cargo barges between ports.

[14] A call represents a visit to a port terminal. A vessel call typically results in two vessel transits: one inbound and one outbound.

Figure 6.4-2. Number of Transits per Location by Vessel Type (2014 AIS Data)

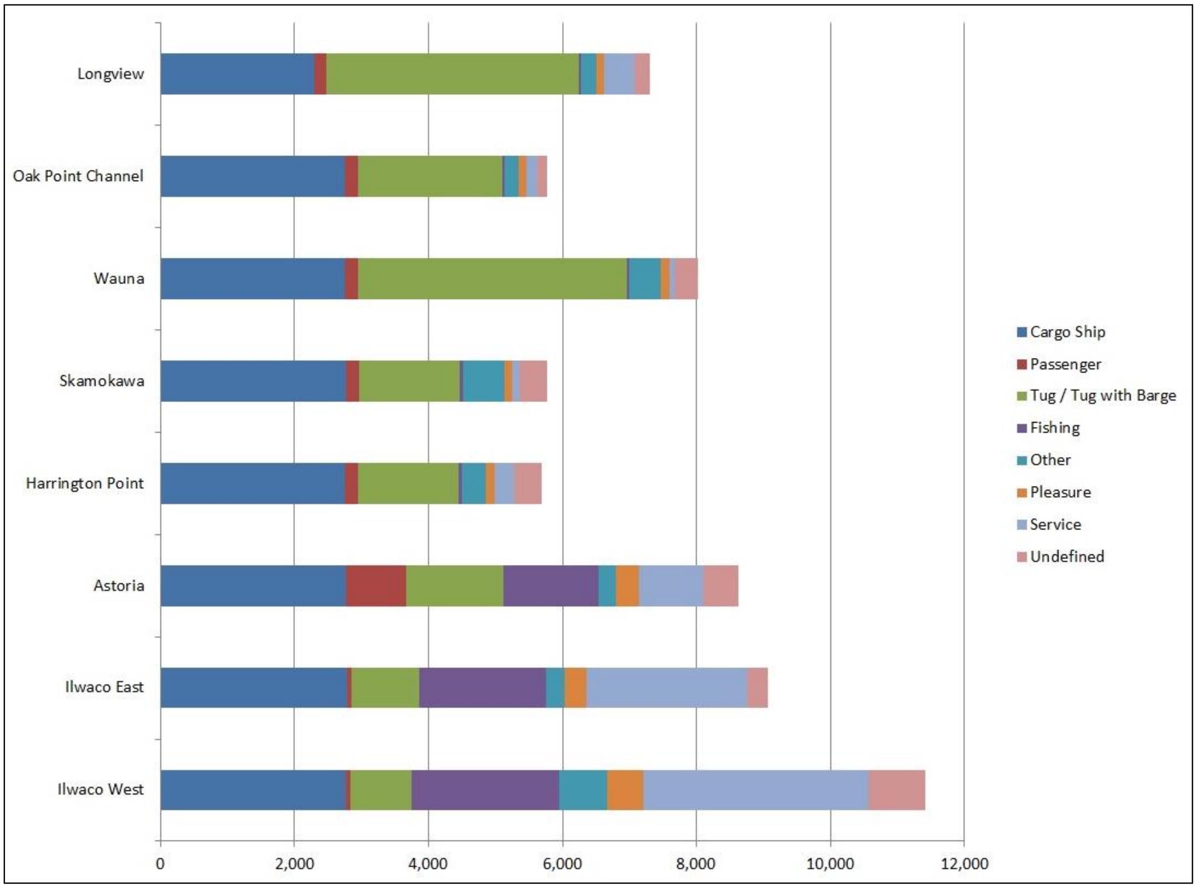
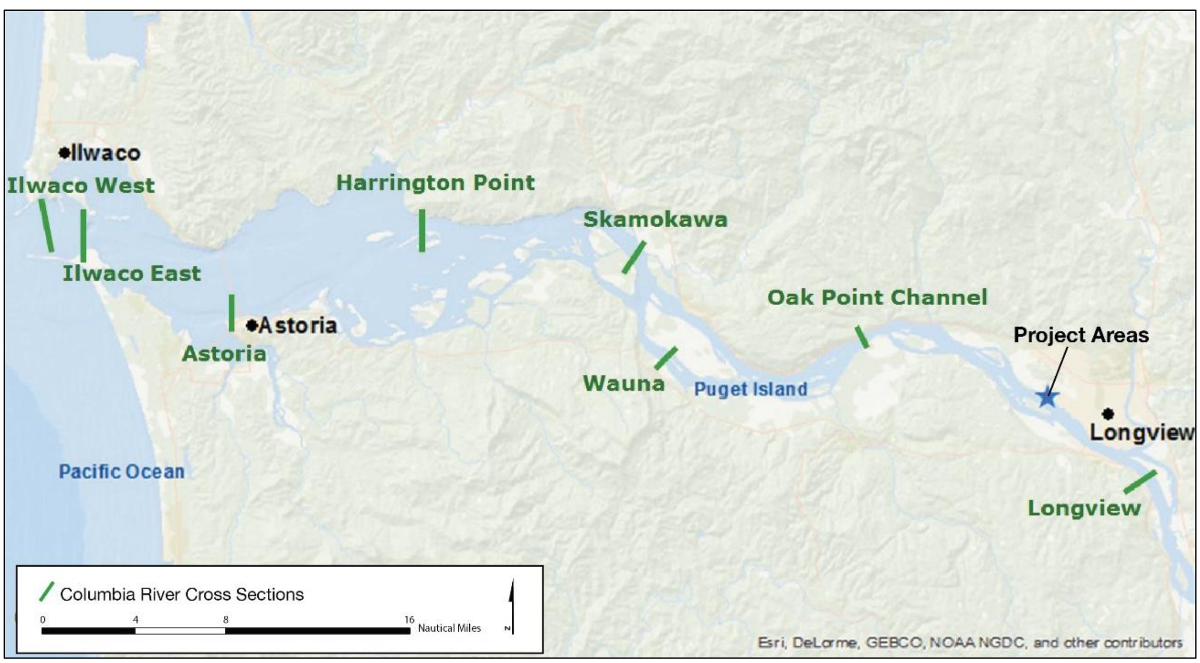


Figure 6.4-3. Vessel Data Location Points



- Port of Portland receives cargo ships (mostly Handymax and Panamax) and barges, cruise ships, and other vessel types (e.g., other commercial passenger vessels, dredges, pollution control vessels, USCG). The cargo vessels transport all types of cargo. The port reported 513 and 352 vessel calls in 2014 and 2015, respectively (Myer pers. comm.).
- Port of Vancouver receives cargo ships (Handymax and Panamax) and barges transporting grain, scrap steel, automobiles, petroleum products, other dry and liquid bulk cargo, and other products. The port also receives commercial passenger vessels (not cruise ships) and dredges. The port reported 450 vessel calls per year in 2014 and 2015 (Ulgum pers. comm.).

Historical Traffic Volumes

Table 6.4-6 shows annual transits[15] of large commercial vessels[16] in the study area over an 11-year period (2004 to 2014), based on Bar Pilots records of bar crossings (i.e., vessels entries to and exits from the Columbia River).

As shown in Table 6.4-6, traffic volumes were similar in 2004 and 2014, but have fluctuated within the time period. For comparison, the historical peak vessel traffic year recorded by the Bar Pilots is 1979 with 4,752 transits[17] (Jordan pers. comm. A); approximately the same level occurred in 1988. In every other year from 1979 to 2000 the number of vessel transits was greater than or very close to 4,000. Since 2001, vessel transits have remained below these levels.

Table 6.4-6. Large Commercial Vessel[a] Transits[b] in the Study Area (2004–2014)

Year	Transits
2004	3,554
2005	3,436
2006	3,618
2007	3,858
2008	3,782
2009	2,926
2010	3,366
2011	3,162
2012	3,178
2013	3,448
2014	3,638

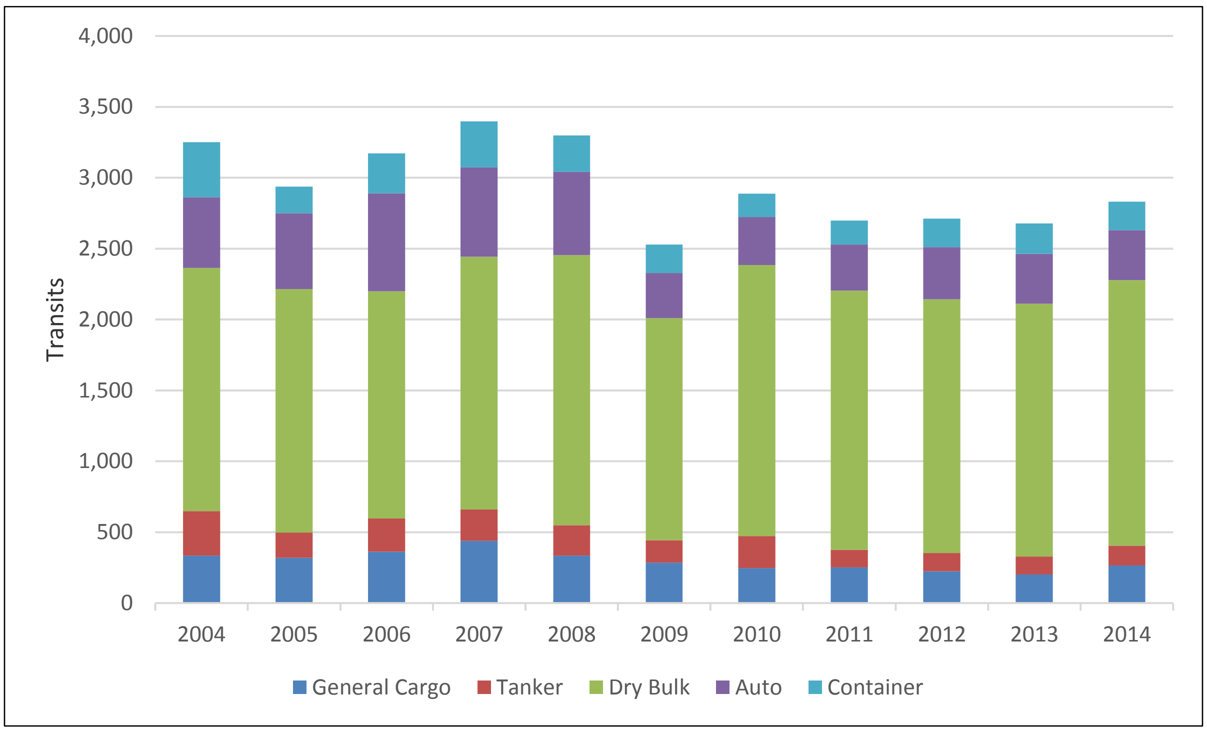
Notes:
[a] A small number (approximately 2% annually) of noncommercial vessels (e.g., military ships and research vessels) are reflected in these data.
[b] Transits recorded in the Bar Pilots data are generally equivalent to bar crossings, (i.e., entries to and exits from the river system); however, a small percentage (approximately 1% annually) reflect in-river vessel movements (e.g., for bunkering or anchorage).
Source: Bar Pilots records (Jordan pers. comm. A)

[15] Bar Pilots record bar crossings or transits (i.e., entries to and exits from the river system); however, these data include a small percentage (approximately 1% annually) of in-river vessel movements (e.g., for bunkering or anchorage).
[16] The Bar Pilot data reflect a small number (approximately 2% annually) of non-commercial vessels (e.g., military ships and research vessels).
[17] The peak traffic year for the Columbia River reflected in the VEAT data is 1999 with 2,269 vessels calls or 4,538 transits (Washington State Department of Ecology 2014).

Although vessel traffic volumes have been considerably lower since 2004 compared to earlier years, vessel sizes and total cargo tonnages have increased. The overall decrease in vessel traffic levels can be attributed to general economic conditions and the deepening of the Columbia River channel. The deepening of the Columbia River channel from 40 to 43 feet has allowed larger vessels with greater drafts to call at river ports, and vessels that previously had to be light-loaded can now be loaded to deeper drafts. This has resulted in the need for fewer, but larger, vessels to move a given volume of cargo; this is especially the case for the dry bulk cargo vessels that make up a high percentage of the river traffic (Krug and Myer pers. comm.; Amos pers. comm.; Jordan pers. comm. B).

Of the vessel transits recorded by the Bar Pilots (2004 through 2014), cargo ships constitute the largest percentage of vessel traffic in the lower Columbia River (around 90% on average); while barges represent 3 to 10% and cruise ships less than 1%, on average. Approximately 3%, consists of a mixture of other vessel types.[18] These cargo ships can be broken down further into specific vessel types, based on the Bar Pilots records. Figure 6.4-4 shows transits by vessel type within the cargo ship category. Dry cargo ship transits represent over half (between 50 and 60%) of the cargo ship traffic annually. The remainder (in descending order of magnitude) were automobile carriers, general cargo ships, container ships, and tankers.

Figure 6.4-4. Percentage of Annual Cargo Ships by Vessel/Cargo Type (2004–2014)



[18] Vessels categorized as *other* include vessels recorded in Bar Pilots data as miscellaneous (occasional military vessel, research vessels, industrial/marine construction, dredges), bunkers, shipyard, and shifts.

Vessel Traffic Management

Management of vessel traffic in the study area is primarily a real-time activity involving the pilots, vessel masters, and PDXMEX.[19] Large commercial vessel traffic moves along the navigation channel in a two-way pattern: one lane inbound and one lane outbound. This simplistic layout constitutes the foundation of the traffic management system. Oversight and active participation in the traffic management involves coordination of all river stakeholders, including USCG, Corps, Ecology, Oregon Department of Environmental Quality (DEQ), pilots, shipping agents, terminal operators, tug operators, and other associations and services. Large commercial vessels area must adhere to international and inland rules (72 COLREGS and Rules of the Road, respectively), described in Section 6.4.1, *Regulatory Setting*. These rules are intended to facilitate safe maritime travel.

Large commercial vessel traffic is also managed with pretransit planning, pilotage requirements (i.e., the use of a licensed bar and river pilot), and pilotage tools that monitor real-time vessel traffic and data on current weather and tidal conditions. These vessel traffic management activities are discussed in detail in the *NEPA Vessel Transportation Technical Report*.

Other Vessels

Other vessels include commercial fishing, recreational, smaller commercial passenger, and service vessels. These vessels are generally much smaller than the vessels discussed in the previous section and have different activity and transit patterns. Most can move about the river without being restricted to the navigation channel.

Commercial Fishing

The Columbia River is divided into six commercial fishery management zones; of these, Zones 1 through 3, and a portion of Zone 4 occur in the indirect impacts study area (NOAA Fisheries 2016). The commercial fisheries in these zones are managed by the states of Oregon and Washington. Zones 1 through 3 support important commercial shad, anchovy, herring, smelt, and salmon fisheries. Commercial fishers deploy gillnets, tangle-nets, or seines depending on species, season, and zone. Several coastal, nearshore, and offshore open-ocean fisheries, including groundfish, halibut, salmon, albacore, pacific whiting, sardines, and shellfish (primarily Dungeness crab and pink shrimp) are present within or adjacent to the indirect impacts study area. Activities range from harvesting to delivery to shore-based processors, depending on the fishery. The mouth of the Columbia River is the busiest part of the study area for commercial fishing vessel traffic, though numbers of operating vessels fluctuate by season and license by fishery.

Tribal Fishing

The treaties of 1855 between the United States and individual tribal governments reserved tribal rights to fish, hunt, and gather traditional foods and medicines throughout ceded lands identified within the treaties. The Columbia River and its tributaries support a variety of tribal resources, including six species of salmon and Pacific lamprey, which have been a reliable and important source of food and trade items to tribes of the Columbia River Compact. The Confederated Tribes

[19] The Merchants Exchange of Portland (PDXMEX) is an information and communication center for ports and stakeholders along the Columbia River. It provides a monitoring system to allow users to locate vessels in the study area and operates a dispatch center to assist in coordinating with River and Bar Pilot dispatch centers to ensure proper vessel traffic management. PDXMEX is also a central point of contact for vessel agents, who provide necessary shore-side services for vessels.

and Bands of the Yakama Nation, Confederated Tribes of the Umatilla Indian Reservation, Confederated Tribes of Warm Springs, and Nez Perce Tribe are the tribes in the Columbia River Basin with reserved rights to anadromous fish in treaties with the United States (Columbia River Inter-Tribal Fish Commission 2016). Tribal fishing resources are described in more detail in Chapter 4, Section 4.5, *Tribal Treaty Rights and Trust Responsibilities*.

Recreational Fishing and Boating

The Columbia and Willamette Rivers are popular areas for recreational boating (motorized and non-motorized), fishing, and other recreational activities (Port of Portland 2010). Over 30 water access and boat launch sites along the Columbia and Willamette Rivers within the indirect impacts study area provide public and private river access for recreational boating and fishing. A section of the Columbia River Water Trail is located in the project area.

Commercial Passenger Vessels

Commercial passenger (non-cruise ship) vessels transit from one port to another within the Columbia River; they include a range of vessels up to 100 gross tons carrying from six to over 150 passengers. Examples of these vessels include the Portland Spirit and Columbia Gorge Sternwheeler, which provide dinner cruises and day trips, respectively, and the Wahkiakum County ferry, the only ferry on the lower Columbia River, which shuttles passengers and up to 12 cars at a time between Puget Island, Washington and Westport, Oregon.

Service Vessels

Service vessels, including military, law enforcement, search and rescue, pilot, pollution control, and tugs operate throughout the study area and could be found anywhere on the lower Columbia River at any time. The vessel types and activities are summarized below.

- USCG vessels are used for search and rescue, maritime law enforcement, boating safety, Aids to Navigation, and homeland security.
- Oregon State Police and Washington State Police operate vessels to coordinate the enforcement of commercial fishery and sport angling regulations, and for special investigations.
- Pilot vessels are used to transport Bar and River Pilots to large vessels for pilotage duties. The Bar Pilots make approximately 3,600 vessel crossings of the bar each year. River Pilots pilot vessels upriver from Astoria.
- Three marine spill response vessels are staged in the study area at the Port of Astoria.
- Tugs operating in the study area include those towing or pushing barges from or to destinations beyond the study area and those from tug companies located along the Columbia River.
- Dredges are used to maintain the navigation channel by removing excess sand, silt, and mud that naturally settles to the bottom and on the sides of the channel over time.

Maritime Law Enforcement

The USCG is the primary federal maritime law enforcement agency on the Columbia River. Oregon State Police and Oregon county law enforcement also patrol the Columbia River (Oregon.gov 2016).

6.4.4.3 Ship Casualty Survey

The information presented in this section is based on data obtained from the USCG MISLE database and covers all available data from 2001 through 2014. The data are collected for 26 vessel incident types and are not predictive of cargo vessel casualties. Three primary incident types—collision, allision, and a combination of grounding/set adrift—are representative of the navigational incidents that could occur and compare best to the results of the incident modeling (Table 6.4-7).

The database notes the severity of each incident and describes potential vessel damage. Table 6.4-8 presents the outcome distribution in three categories—total loss,[20] damaged, and undamaged—for marine incidents that took place between the Columbia River mouth and the Port of Portland. The results of these data survey are very similar to those from nationwide incidents in that approximately two-thirds of incidents resulted in no damage, one-third in some damage, and slightly less than 3% in total loss.

Table 6.4-7. Incident Severity by Incident Type for Study Area (Total Incidents, 2001–2014)

Damage Status	Total Loss (% of Total)	Damaged (% of Total)	Undamaged (% of Total)	Total
Allision	3 (5%)	24 (43%)	29 (52%)	56
Collision	1 (5%)	9 (47%)	9 (47%)	19
Grounding /Adrift	1 (1%)	16 (21%)	59 (78%)	76
Total[a]	**5 (3%)**	**49 (32%)**	**97 (64%)**	**151**

Notes:
a Total may not sum due to rounding.
Source: DNV GL 2016

Table 6.4-8. Outcome Distribution for All Incidents in the Study Area by Vessel Type (2001–2014)

Damage Status	Total Loss (%)	Damaged (%)	Undamaged (%)	Total (%)
Bulk Carrier	0%	2%	16%	18%
General Dry Cargo Ship	0%	1%	3%	4%
Ro-Ro Cargo Ship	0%	1%	1%	2%
Tank Ship	0%	0%	2%	2%
Barge	0%	2%	7%	9%
Passenger Ship	1%	8%	7%	15%
Towing Vessel	0%	7%	13%	20%
Fishing Vessel	2%	5%	13%	21%
Recreational	1%	3%	0%	3%
Military ship	0%	1%	0%	1%
Unspecified	0%	1%	3%	4%
Miscellaneous	0%	1%	0%	1%
Total[a]	**3%**	**32%**	**64%**	**100%**

Notes:
[a] Total may not sum due to rounding.
Source: DNV GL 2016

[20] For the purposes of this analysis, *actual total loss*, *total constructive loss: salvaged*, and *total constructive loss: unsalvaged* were combined into a single *total loss* category.

Table 6.4-7 shows groundings were the most common type of incident, followed by allisions, then collisions. Although collisions represented less than 13% of total incidents during the survey period, they resulted in the highest severity outcomes, followed closely by allisions; groundings resulted in significantly less severe outcomes (78% of grounding resulted in no vessel damage). Table 6.4-8 presents the distribution of incident severity for all incidents by vessel type. The table shows the higher severity events more typically involved smaller craft (e.g., fishing or recreational vessels).

6.4.4.4 Marine Oil Spill Survey

Vessel-related oil spills in the lower Columbia River from 2004 to 2014 are presented in Table 6.4-9 by spill volume and incident type, based on MISLE, SPIIS, and ERTS data. The vessel-related spill survey was largely confined to the specified time period (2004 to 2014) because this was the period of best overlap among all the datasets and because it provides a representation of present risk. Spill volumes per incident ranged from 0.1 gallon to 1,603 gallons. An average 15.6 oil spills per year occurred during the study period; of these, 84% had a volume of less than 10 gallons. As reflected in Table 6.4-9, most of the spills were not related to a vessel incident. Spills greater than 100 gallons occurred at a frequency of 0.4 per year or once every 2.2 years. The average size of these spills was approximately 630 gallons.

Table 6.4-9. Oil Spill Incident Count and Frequency—Lower Columbia River (2004–2014)

	Oil Spill Incident Count by Spill Volume					
Incident Type	**<1 gal gallon**	**1–10 gallons**	**10–100 gallons**	**>100 gallons**	**Total**	**Oil Spills per Year**
Allision	1	-	-	-	1	0.1
Capsize	1	-	-	-	1	0.1
Damage to the environment[a]	123	57	28	6	214	15.3
Grounding	-	-	1	-	1	0.1
Sinking	-	2	-	-	2	0.1
Total	**125**	**59**	**29**	**6**	**219**	**15.6**
Spills per year	**8.9**	**4.2**	**2.1**	**0.4**	**15.6**	

Notes:

[a] This category includes all other incident types and undetermined events including but not limited to those causing an oil sheen, which requires reporting under state law.

Larger-scale incidents involving the release of oil have occurred in previous years; however, these events predate legislation targeted at, and largely successful in, reducing the likelihood of oil spills from vessels or diminishing the impact of a spill should it occur.

6.4.4.5 Incident Management and Response Systems

The National Contingency Plan, codified in 40 CFR 300, establishes federal on-scene coordinators for oil spills and hazardous material releases within the inland zone and coastal environments. The plan is the foundation document for state, regional, and local planning for pollution response and provides organizational focus for the related emergency situations linked to oil spills such as vessel groundings, collisions, allisions, and fires.

USCG is the federal on-scene coordinator. In Washington State, Ecology is the designated state on-scene coordinator for spill response. The Washington Emergency Management Division functions in this role for natural disasters, and Washington State Patrol or state fire marshal for fires. The Washington State Emergency Response system is designed to provide coordinated state agency response, in cooperation with federal agencies for effective cleanup of oil or hazardous substance spills. Within Oregon, DEQ is the lead agency for oil or hazardous material spills, the Oregon Office of Emergency Management coordinates support from other state agencies, and the state fire marshal provides hazardous materials/fire incident response coordination and support when a situation exceeds local response capabilities.

The Northwest Area Contingency Plan is the regional planning framework for oil and hazardous substance spill response in the states of Washington, Idaho, and Oregon. Representatives from the federal and state agencies listed above and local governments plan for spill response emergencies and implement response actions according to the plan when an incident occurs. Geographic response plans, part of Northwest Area Contingency Plan, are tailored for specific shorelines and waterways. The main objectives of these plans are to identify sensitive resources at risk from oil spills and to direct initial response actions to sensitive resources.

In addition to the national and regional plans, the Lower Columbia Region Harbor Safety Committee maintains the Harbor Safety Plan, which includes incident management guidelines; emergency communications; notification requirements in case of an oil spill; steps to take in case of a vessel grounding, vessel collision, bridge allision, and mechanical or equipment failures.

All of these plans help coordinate response efforts by the responsible party (vessel owner/operator) and federal and state agencies.

Owners/operators of large commercial vessels are required to prepare and submit oil spill response plans under federal (33 CFR 155.5010-155.5075) and state requirements (WAC 173-182) to ensure resources, including equipment, are in place for a spill of the vessel's fuel oil and of any oil carried as secondary cargo. Moreover, vessel owners/operators are required to retain an oil spill removal organization and a spill management team; this is often accomplished by contracting with cooperative organizations that specialize in oil spill response, such as the Marine Spill Response Organization and National Response Corporation.

Additionally, vessel owners/operators can obtain oil spill response and contingency planning coverage under the Maritime Fire Safety Association (MFSA) response plan, an umbrella plan for enrolled vessels entering the Columbia River.

6.4.5 Impacts

This section describes the potential direct and indirect impacts related to vessel transportation from construction and operation of the proposed export terminal.

6.4.5.1 On-Site Alternative

Construction—Direct Impacts

Construction-related activities would include demolishing existing structures and preparing the site, constructing the rail loop and dock, and constructing supporting infrastructure (e.g., conveyors and transfer towers).

Dock construction (pile-driving, dredging, and general construction of above-water elements) would occur over a 6-month to 1-year period (Grette Associates, LLC 2014). For this work, barges would be located near Docks 2 and 3. The barges would be positioned outside of the navigation channel, so as to not impede vessels traveling within the channel. They would also be placed outside of the area used by vessels accessing Dock 1, so they would not affect these activities. The On-Site Alternative would not result in direct impacts on vessel transportation during construction activities. Additional information on dredging and pile driving is included in Chapter 5, Section 5.5, *Water Quality*.

Construction—Indirect Impacts

As described in Chapter 3, *Alternatives*, the Applicant has identified three construction material delivery scenarios: delivery by truck, rail, or barge. If material is delivered by barge, it is assumed approximately 1,130 barge trips would be required during the construction period. Approximately two-thirds of the barge trips would occur during the peak construction year, assumed to be 2018. Approximately 750 barge trips in the study area would be required during the peak construction year to deliver construction materials. Because the project area does not have an existing barge dock, the material would be off-loaded at an existing dock elsewhere on the Columbia River and transported to the project area by truck.

Barges are shallower in draft and could transit the Columbia River navigation channel during periods of low water to avoid interference with larger vessel traffic. Coordination would take place with the River Pilots prior to and during transit activity. Moreover, the barges would be transiting a portion of the navigation channel during construction in the vicinity of the project area and not the entire study area. Therefore, impacts on vessel traffic in the study area as a result of construction-related barge traffic would be low because construction barge traffic would avoid interference with larger vessels and would only traverse a local portion of the lower Columbia River.

Operations—Direct Impacts

Loading coal onto vessels for export is the only activity proposed for the new docks, Docks 2 and 3. Vessel loading would be performed using an electric-powered shiploader. Each dock would have one shiploader and each shiploader would have an average capacity of 6,500 metric tons per hour. At maximum throughput, an average of 70 vessels per month (an average of over two per day) would be loaded at Docks 2 and 3. The berths for Docks 2 and 3 are expected to be occupied by project-related vessels 365 days per year.

River Pilots would pilot the incoming and outgoing vessels (from Astoria inland and vice versa) and direct docking and undocking maneuvers. At least two tugs would be used to assist with docking and undocking maneuvers for each arriving and departing project-related vessel. Therefore, at least two tugs would be active in the vicinity of the docks four times per day on average. The pilot would determine the appropriate size and horsepower of the tugs depending on factors such as the size of the vessel, the weather conditions, and the currents at the time of maneuvers.

Docks 2 and 3 would be designed to accommodate dry bulk cargo ships up to 830 feet long and 130 feet wide, which would accommodate standard Panamax vessels and the somewhat smaller Handymax vessels. The berths at Docks 2 and 3 would be 43 feet deep, which is the depth at which the Columbia River navigation channel is maintained (U.S. Army Corps of Engineers 2015a).

The expected fleet mix is 80% Panamax and 20% Handymax vessels. Table 6.4-10 contains the size and dimensions of these types of vessels assumed for the risk analysis.

Table 6.4-10. Vessel Sizes and Dimensions for Panamax and Handymax Vessels Assumed in the Risk Analysis

Vessel Class[a]	Deadweight (tons)	Length Overall (feet)	Beam (feet)	Draft (feet)
Handymax	46,101	600	106.0	36.1
Panamax	68,541	738	105.6	43.6

Notes:
[a] These specifications chosen to represent the size and dimensions for Panamax and Handymax vessels are representative of an "average-sized" Panamax vessel and an average-sized Handymax vessel.
Source: DNV GL 2016: I-4.

Operations impacts related to the On-Site Alternative are based on the following assumptions.

- The River Pilots anticipate (Gill pers. comm.) turning the ships at the project area in loaded condition (i.e., in preparation for departure, as opposed to turning downriver upon arrival).[21] Thus, inbound ships would approach Docks 2 and 3 in ballast (headed upriver), maneuver out of the navigation channel toward the dock, and align parallel to the dock, docking with the assistance of tugs.
- Pilots estimate operations at the project area (Docks 2 and 3) would require the two assisting tugs to have bollard pull ratings of at least 30 tons operating ahead and at least 22.5 tons operating astern. Those tugs would be in the 3,000-to-4,000-horsepower range (Gill pers. comm.). Pilots would determine if tugs are needed.
- A typical departure of a loaded vessel off the dock (with the assistance of the tugs) would involve moving the bow out into the channel while keeping the stern near the dock to give the pilot accurate positioning of the vessel during the turn, and allowing the current to rotate the bow until the vessel points downriver and can begin moving downriver. The width of the channel at this point is approximately 1,200 feet, which provides a turning area approximately 1.6 times the length of the vessel.
- Currently, maneuvering a vessel to the existing berth (Dock 1) can be challenging upriver of the project area due to the strong current outflow from the bank (Amos pers. comm.). Pilots expect conditions for the proposed docks (Docks 2 and 3) would be the same as they are at Dock 1 (Gill pers. comm.). Pilots would be aware of this issue and would consider it during planning and operations.

Should an accident occur during operations, it would most likely be attributable to a vessel fire, oil spill, or allision while at the dock. Each of these situations is discussed below.

Risk of a Vessel Fire while at the Dock

Coal in any form, is a combustible material, making it susceptible to a variety of ignition scenarios. Coal fires during transfer and loading operations are typically caused by one of two sources of ignition: the coal itself (self-ignition) and the conveyor belt used in the transport of

[21] Currents in the river at the project area are typically directed downriver or ebbing due to the river flow overriding the tidal currents. It is expected to be more efficient and safer to dock the ship heading into the current using the forward power of the engines which is stronger than the vessel's backing power. When the loaded vessel leaves the dock with the bow pointing upriver, the currents assist the vessel turning in the channel by pushing the bow around and downriver.

coal (e.g., over-heating due to damaged bearings, roller, belt slip). Safety requirements prohibit open flames near coal loading operations.

A fire in the vessel's machinery spaces or accommodation areas is a potential emergency scenario. Vessel design standards, fire equipment requirements, and crew training would be required to prevent or to facilitate rapid response to a vessel emergency while at the dock. All of these standards and requirements are implemented in accordance with the International Convention for the Safety of Life at Seas (SOLAS) in foreign and domestic cargo vessels (and codified in U.S. regulations) and enforced by USCG.

A bulk carrier such as the project-related vessels would have the following fire prevention and response features.

- Structural fire protection, including certain bulkheads constructed to prevent the passage of flame and smoke for 1 hour. Other bulkheads must be constructed of incombustible materials. Current regulations require risk of fire hazards be eliminated as much as possible in other construction features of the vessel (46 CFR 92).
- Structural insulation around compartments containing the emergency source of power (such as the ship's service generators). Other approved materials capable of preventing an excessive temperature rise in the space may also be used to eliminate the spread of a fire that originates in this type of compartment (46 CFR 92).
- Fire pumps, hydrants, hoses, and nozzles for the purposes of onboard firefighting. In addition, certain spaces must have approved hand-portable fire extinguishers and semiportable fire extinguishing systems (46 CFR 95).
- Officers and crewmembers with a basic level of training, including fire prevention and firefighting (U.S. Coast Guard 2014).

Within the hold of a vessel, coal can be susceptible to ignition due primarily to self-heating and/or the creation and subsequent ignition of certain gases, including methane and hydrogen. Fire detection systems including carbon monoxide detection and infrared scanning would be in place to monitor and minimize the potential for onboard coal fires. Additionally, manual scanning by workers would enhance built-in mechanical-detection systems. Automated fire-suppression systems activated in the early stages of fire development are critical to reducing the potential for flame spread. These typically include water sprinklers combined with a fire extinguishing agent such as wetting agents or foam. Therefore, an onboard emergency is unlikely to affect resources other than the vessel itself.

Risk of an Oil Spill while at the Dock

An operational oil spill at the dock would most likely occur during bunkering (i.e., a ship receiving fuel while at the dock). However, the Applicant has committed to not allowing vessel bunkering at Docks 2 or 3, so there would be no risk of an oil spill at a dock associated with oil transfers. Oil spill risks during transit are addressed under *Operations—Indirect Impacts*.

Risk of a Vessel Allision at the Dock

An allision occurs when a vessel strikes a fixed structure, such as a project-related vessel striking the proposed docks at the project area or another vessel striking a project-related vessel at berth.

Pilots sometimes experience difficulties getting a ship to the berth at the existing Dock 1, located just upriver of proposed Docks 2 and 3. Information about maneuvering challenges at Docks 2 and 3 cannot be collected and evaluated until the docks are built and vessel maneuvers take place at the project area. Nevertheless, the pilots' experience at nearby Dock 1 in the Applicant's leased area introduces a certain level of uncertainty associated with the aggregate influence of currents and river flow at Docks 2 and 3. A potential outcome when there are strong currents in the vicinity of the dock during vessel maneuvers is an allision. An allision may also occur if there were a loss of steering or loss of propulsion during transit or maneuvering at the dock. Despite the uncertainty associated with vessel maneuvers at the dock, the likelihood of a vessel allision is lessened due to the presence of tug power while docking and undocking.

Risk of allision could also involve another vessel striking a project-related vessel while the project-related vessel was at berth. Several ports are located upriver of the project area and other vessels traveling to and from those locations would pass the project area. Based on incident modeling (DNV GL 2016), the likelihood of an allision under the On-Site Alternative is once in 39 years. However, as noted in Section 6.4.4.3, *Ship Casualty Survey*, most allisions do not result in substantial consequences, such as total vessel loss. From 2001 and 2014, only 5% of allisions resulted in total vessel loss, and all of these events involved only fishing vessels.[22]

Operations—Indirect Impacts

All large commercial vessel traffic bound for Longview or ports further upriver, including the Port of Portland and Port of Vancouver, pass the project area. Transiting project-related vessels could affect or be affected by other vessel movements in the study area. Moreover, increased vessel traffic could result in changes in wake patterns, increased propeller wake, and increased underwater noise, and vessel emissions that could affect other environmental resources. These impacts are addressed in Chapter 5, Section 5.5, *Water Quality*, and Sections 6.5, *Noise and Vibration,* and 6.6, *Air Quality*. Impacts on the vessel transportation system and related environmental resources along the Columbia River navigation channel outside the project area due to vessel operations are considered to be indirect impacts.

Risk of Vessel Incidents during Transit

Factors influencing the potential for incidents during vessel transport are complex but are driven largely by changes in the pattern of vessel traffic particularly those vessels limited to the navigation channel. Table 6.4-11 compares large commercial vessel traffic under existing conditions (based on 2014 AIS data), No-Action Alternative (2028), and On-Site Alternative (2028).

For the purposes of incident modeling, the baseline traffic year of 2014 was selected to represent relatively recent traffic conditions on the river.

[22] The data also show between 2001 and 2014, 4% of the allisions resulting in some damage were bulk carrier allisions.

Table 6.4-11. Existing and Projected Large Commercial Vessel Traffic in the Lower Columbia River

Condition	Vessel Transits[a] per Year
Existing Conditions (2014)	3,862
No-Action Alternative (2028)	4,440
On-Site Alternative (2028)	6,120

Notes:

[a] Transit numbers differ slightly from those presented in Table 6.4-6 in the discussion of historical vessel traffic volumes (Section 6.4.4.2, *Vessel Traffic*). The 2004–2014 historical volumes presented in the table are based on Bar Pilot data, whereas the transits presented here, which were the basis for the DNV GL (2016) risk assessment, are based on AIS data. The variance is a result of different recording methods and vessel type designations of the data sources.

Source: Based on 2014 AIS data for Cargo/Carrier, Tanker, Tug, and Passenger vessel types; a projected growth rate of 1% was applied to the 2014 transits to obtain the 2028 vessel transits under the No-Action Alternative; and proposed vessel transits (1,680) were added to the no-action transits to obtain transits with the On-Site Alternative.

The vessel incidents evaluated in the modeling include allision, collision, grounding (powered or drift), and fire/explosion, because they are most likely to result in substantial consequences if they occur (Section 6.4.4.3, *Ship Casualty Survey*). Incident modeling considered the interaction between project-related vessels and other large commercial vessels using the channel, as well as smaller vessels (e.g., recreational boats or commercial fishing vessels) not limited to the channel.

Risk of a Vessel Allision (with a Fixed Object) during Transit

For vessels outbound from the project area, no fixed structures or waterfront facilities are close to the edge of the channel until the Port Westward dock at river mile 53 (Figure 6.4-1) and a small barge terminal dock at river mile 36. Thereafter, there are no facilities or structures until reaching the Port of Astoria, and those structures are well clear of the channel. The Astoria-Megler Bridge is the next structure encountered. The remaining structures are the jetties at the entrance of the river.[23] Due to the minimal impediments to vessel traffic within the navigation channel, the likelihood of a project-related vessel alliding with a fixed structure while in transit is so low it was not quantitatively evaluated in the risk assessment (DNV GL 2016). As shown in Table 6.4-7, 56 vessel allisions occurred in the study area from 2001 to 2014 (compared to over 3,000 vessels transits annually during this time). Of these, just over half (52%) resulted in no damage, 43% resulted in some level of damage, and 5% resulted in total loss (all were fishing vessels). Therefore, while the risk of vessel allisions would increase when compared to current conditions, the overall risk of a project-related vessel being involved in an allision would be very low.

[23] Since they are piloted, large commercial vessels have an advantage over fishing and recreational vessels because pilots are specifically trained to keep a large commercial vessel from alliding with a known object in the navigation route, including a bridge. There was an allision at the Astoria-Megler Bridge involving a piloted vessel approximately 30 years ago. Since this incident, Bar Pilots have implemented risk reduction measures to reduce the probability of allisions at the bridge; they avoid meeting other piloted vessels at the bridge, observe weather and river current conditions, and review weather forecasts before transiting under the bridge (DNV GL 2016: 69).

Risk of Other Incidents during Transit

Increased risks associated with additional vessel traffic also include the potential for more collisions, groundings, or fires/explosions. As presented in Table 6.4-12, operation of the terminal would increase the potential for incidents compared to existing condition (2014) and the No-Action Alternative (2028). The total predicted incident frequency in 2028 is 19.4 incidents per year under the No-Action Alternative and 22.2 incidents per year with the On-Site Alternative. The predicted increase in incidents is primarily because of the increase in the number of vessels transiting the lower Columbia River with the On-Site Alternative. Consequences of a modeled incident can vary greatly from no damage to total loss and the increase in likelihood alone is not representative of the magnitude of the potential consequences. In other words, not all of these incidents are likely to result in notable damages. For example, of the 151 reported incidents in the study area from 2001 through 2014 (Table 6.4-7), 64% resulted in no damage, 32% resulted in damage, and 3% resulted in total loss.

Table 6.4-12. Predicted Incident Frequencies per Year in the Study Area

	Predicted Incident Frequency				
Scenario	**Predicted Collision**	**Predicted Powered Grounding**	**Predicted Drift Grounding**	**Predicted Fire/ Explosion**	**Total**
Existing Conditions (2014)	1.94	11.8	2.8	0.0032	16.6
No-Action Alternative (2028) Conditions	2.53	13.6	3.3	0.0037	19.4
On-Site Alternative (2028) Conditions	2.91[a]	14.4	3.6	0.0040	22.2

Notes:
[a] Predicted collision incident frequency for the On-Site Alternative includes the likelihood that a non-project vessel would strike a project vessel at berth (collisions and allisions).
Source: DNV GL 2016

Additionally, the incident frequencies predicted for existing conditions are from a single year (2014). While this year accounts for higher vessel traffic compared to the previous few years, it does not account for the wide historical variation in vessel traffic. Further, because the On-Site Alternative would ramp up over time, comparing the addition of 840 vessels to existing conditions is a conservative estimate; incident frequencies would be lower until the terminal is operating at full capacity and loading all 840 vessels yearly. Therefore, it is important to also consider how the No-Action Alternative would compare to existing conditions and how the On-Site Alternative would compare to the No-Action Alternative. As shown in Table 6.4-12, a relative increase in the likelihood of all incident types would occur over time unrelated to the On-Site Alternative.

Collisions

In general, the River Pilots and Bar Pilots avoid overtaking situations where one vessel passes another from behind. Thus, the most likely collision scenario is an inbound vessel meeting an outbound vessel. The River Pilots have identified specific points on the river where conditions are not suitable for vessels to pass each other, and they carefully manage transits to avoid two vessels meeting in those locations. Avoidance of these areas was taken into consideration in calculating collision risk.

The most likely collision scenarios are bow-to-bow and side-to-side contact involving two large commercial vessels transiting the navigation channel. Bow-to-side is a possibility, but the channel width and the sizes of the vessels would likely make it more of a glancing impact rather than a straight ahead "T" impact.

Bow-to-bow contact is generally viewed as the easiest type of collision to avoid because the target area is small and either vessel can act independently to avoid it. Also, a vessel's bow is its strongest structural point and bow-to-bow collisions would not be expected to result in cargo hold damage or fuel oil release. In addition, the hydrodynamic interaction between ships meeting causes the bows to be pushed away from each other as they approach.

Side-to-side or a glancing bow-to-side collision could result in damage to the hull, but the likelihood of catastrophic damage is relatively low. For dry cargo vessels—including bulk carriers—it is unlikely any cargo would be released into the water in the event of an angle of impact less than 22.5 degrees (DNV GL 2016). For tank vessels—including ATBs carrying oil in bulk—the risk of an oil spill cannot be ruled out; however, modern tank vessel design standards, including double hull construction of tankers, substantially reduce the potential.

The Columbia and Willamette Rivers provide important fisheries for commercial, tribal, and recreational purposes. Although fishing vessels are not restricted to the navigation channel, they often cross the channel, particularly during periods of high fishing activity. However, in general, because these smaller vessels are not restricted to the channel and must by law yield to oncoming large commercial vessels, the potential for a collision between a smaller vessel and a project-related vessel would be low. Incident modeling showed a very small increase in the potential for collisions involving fishing boats (0.04 incident per year) and recreational boats (0.01 incident per year).

Groundings

While a collision may seem like a more likely incident scenario in the two-lane channel, the vessel casualty data (Table 6.4-7) and incident modeling results (Table 6.4-12) show groundings, specifically powered groundings, are more likely under all traffic scenarios. The River Pilots noted there are few areas where waterway conditions create a substantial chance for an accidental grounding to occur. For example, during periods of low water (generally between September and November) pilots give adequate consideration to under-keel clearance to avoid touching bottom. They also noted the nature of the river channel provides a bank cushion effect to help keep vessels away from the channel edges[24] (Amos pers. comm.).

Fires, Explosions, and Other Emergencies

Equipment failure affecting power or steering while the vessel is underway could lead to loss of control of a vessel. A fire in the vessel's machinery spaces or accommodation areas is also a potential emergency scenario. For any of these situations the vessel master would do what is necessary to protect the safety of the crew first and avoid damage to the vessel second. A

[24] When the vessel is near to the bank, the water is forced between the narrowing gap between the vessel's bow and the bank. This water tends to create a "cushion" that pushes the vessel away from the bank.

prudent action would be to remove the vessel from the navigation channel to a "safe haven," a location where appropriate actions can be taken by the vessel crew without compounding the emergency by involving another vessel or structure. Safe haven opportunities on the river are minimal. Marine terminals at the port areas and designated anchorages are the only places where vessels can stop to manage an emergency. Two anchorages at Astoria can accommodate five deep-draft vessels, at most, depending on their sizes. There are no other anchorage areas until reaching Longview (past the project area). Once a loaded vessel gets underway inbound to or outbound from the Longview area, it is committed to completing the planned transit.[25]

Nothing prevents a vessel's master from anchoring anywhere in the river under emergency conditions; however, there is no way to predict how successful such an action might be in stopping the vessel. Anchoring effectiveness is dependent on factors such as the nature and condition of the waterway bottom, water depth, and vessel speed at the time of the anchoring. Risks include the potential for the anchor to damage the vessel if the water is not sufficiently deep. The vessel's location in or near the channel could also hamper or endanger other vessels depending on its location at the time. Dropping an anchor or anchors in an attempt to stop a vessel would be done only if other control measures failed. Opportunities for these emergency measures would be discussed as part of the pre-transit planning between the master and the pilot.

In an emergency, a vessel could anchor in the channel at some locations; however, this presents significant risks for the vessel regarding the narrow channel and most likely would block virtually all other traffic. The likelihood of a vessel emergency causing a collision is low. Safe haven limitations (described above) mean vessel transit would not begin until everyone involved is satisfied the vessel is fully capable of completing the transit.

Although a vessel emergency increases the likelihood of indirect impacts on the Columbia River waterway (such as a bunker oil spill), the likelihood of such an emergency occurring is very small. As shown in Table 6.4-12, the likelihood of fires and explosions is substantially lower than any other type of incident considered in the risk assessment. For example, fires and explosions are predicted to occur approximately 0.004 times per year compared to a predicted total incident frequency of 22.2 incidents per year. If such an emergency were to occur, the presence of a qualified vessel master and the pilot, in addition to crew training, vessel design, and equipment would help minimize the harmful impact on human safety and environment.

Risk of a Bunker Oil Spill during Transit or at Anchorages

In general, the risk of bunker oil spills would increase under the On-Site Alternative due to the number of vessels that would call at the terminal and the resulting increase in overall vessel traffic in the river. Accident risk modeling estimated the increased likelihood of oil spills caused by a collision or grounding under the On-Site Alternative.

[25] A number of potential sites for additional anchorages are being discussed by the waterway stakeholders; however, they generally are shallow water sites. Reportedly, the discussions include the possibility of the Corps maintaining those areas as part of the navigation channel. Provision of additional stern buoys is also being considered.

Tables 6.4-13 and 6.4-14 present the likelihood (in terms of "return period"[26]) of representative spill sizes resulting from an increased risk of collisions and groundings, respectively, under the On-Site Alternative.

Table 6.4-13. Example Bunker Oil Spill Volumes and Frequencies due to Collisions Related to the On-Site Alternative (2028 and 2038)

Return Period (years)[a]		
2028	**2038**	**Oil Spill Volume (gallons)**
341	224	20,900 or less
581	381	59,300 or less
676	444	107,400 or less
3,748	2,461	166,500 or less

Notes:
[a] Frequency of collisions in 2038 is higher compared to 2028 due to an increase in the overall vessel traffic in the study area.
Source: DNV GL 2016

Table 6.4-14. Example Bunker Oil Spill Volumes and Frequencies due to Groundings Related to the On-Site Alternative (2028 and 2038)

Return Period (years)[a]	Oil Spill Volume (gallons)
140	5,700 or less
182	10,700 or less
403	39,700 or less
4,299	45,800 or less

Notes:
[a] Grounding frequencies do not vary from 2028 to 2038 since the number of project vessels remains at 840 in both years.
Source: DNV GL 2016

As shown in the tables, the likelihood of bunker oil spills from a vessel incident is relatively low with the most likely scenarios occurring in the range of once every 224 years for collisions (2038 traffic levels) and once every 140 years for groundings (2028 or 2038 traffic levels). As noted in Section 6.4.4.4, *Marine Oils Spill Survey*, historical spills in the study area are much smaller than the quantities indicated in Tables 6.4-13 and 6.4-14 and have ranged from 0.1 gallon to 1,603 gallons.[27] The average number of oil spills within this same timeframe (2004 to 2014) is 15.6 spills per year with 84% having a volume of less than 10 gallons. Spills of more than 100 gallons have occurred at a frequency of 0.4 per year or once every 2.2 years. The average size of these relatively larger spills is approximately 630 gallons.

The reason the potential spill sizes are larger is because the spill scenarios presented above are associated with large-scale vessel incidents: collisions or groundings. For such an incident to result in a release of bunker oil, the energy involved in the initial incident must be great enough to puncture the vessel's tanks. Increases in the types of oil spills of a scale more similar to those over the last 10 years or so would also be expected to be commensurate with the relative

[26] Estimated period of time between occurrences of an event.

[27] Data presented in Section 6.4.4.4, *Marine Oil Spill Survey*, include all reported vessel-related spills from 2004 to 2014, not just those caused by vessel incidents such as groundings and collisions.

increase in vessel traffic. Expansion of the casualty survey to a longer (beyond 11 years) timeframe, would include more unlikely events of a larger scale more in line with those addressed by the incident modeling.

An amendment to the International Convention for the Prevention of Pollution from Ship (MARPOL) Annex that went into force in 2007, included a new regulation 12A on oil fuel tank protection. This regulation applies to any ship with an aggregate oil fuel capacity of 785 cubic yards (3,774 barrels [158,508 gallons] of oil equivalent) or more and was contracted for on or after August 1, 2007; or had a keel laying date on or after February 1, 2008; or was delivered on or after August 1, 2010. The regulation limits an individual fuel tank to a maximum capacity limit of 3,270 cubic yards (15,725 barrels) and also includes requirements for the protected location of the fuel tanks and performance standards for accidental oil fuel outflow. It requires consideration of general safety aspects, including maintenance and inspection needs, when approving the vessel's design and construction. These improvements have helped to reduce the extent of releases in the event of a vessel incident.

Increased vessel traffic associated with the proposed export terminal could also increase the risk of oil spills during bunkering activities. Causes of oil spills during bunkering transfers include overflow of the tank, parting of the hose due to mooring fault, operator error in connecting the hose, failure of the hose or pipework, and failure of bunker tanks. Experience from insurance claims (Gard 2002) indicates most bunker spills result from an overflow of the bunker tank due to carelessness or negligence, either on the part of those supplying the bunkers, or those on board the vessel receiving them. The main safeguards against the occurrence of bunker spills are use of bunkering best practices, including attentive tank-level monitoring and valve alignment, use of bunkering procedures and checklists, and supervision of the bunkering operation by a qualified person.[28] Standard/ABS (2012) lists the main features of such procedures.

The consequences of a spill of heavy fuel oil into the marine environment are in general considered to be more severe than for other fuels, although this may depend on the sensitivity of the local environment to acute toxicity (DNV 2011). Undoubtedly, spills of heavy fuel oil will be more persistent, taking longer to weather naturally and being more difficult to clean up. The average cleanup costs per metric ton of oil spilled have been estimated as more than seven times higher for heavy fuel oil[29] than for diesel (Etkin 2000).

There were nine oil spills during refueling of large cargo vessels in the lower Columbia River from 2004 to 2014. Spills of oil cargoes are better documented than spills from bunkering. Therefore, previous risk analyses (e.g., DNV 2011) have assumed the frequency of spills during bunkering is the same as during transfer of liquid cargoes: 1.8 by 10^{-4} per bunkering operation (one spill every 5,555 years) for spills exceeding 1 metric ton (7.3 barrels or 308 gallons). The frequency of smaller spills would be greater. Although it is not possible to predict the number of vessels bunkered or where they would bunker, the risks of a spill in the lower Columbia River would increase only slightly due to the increase in vessel trips under the On-Site Alternative.

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[28] *Bunkering Best Practices: A Reference Manual for Safe Bunkering Operations in Washington State* (Washington State Department of Ecology 2014) and Bunkering Guidelines in *Lower Columbia Region Harbor Safety Plan* (January 2013). These references provide extensive guidelines related to winds, sea states, mooring equipment, tug availability, and regulatory requirements to provide for safe, spill-free bunkering operations.

[29] Heavy fuel oil is used in marine main diesel engines. It is a residue from crude oil refining and because of its properties, heavy fuel oil is required be stored and used at a high temperature.

Vessel Activity

Increased vessel traffic associated with the proposed export terminal would also result in other impacts from vessel wakes, propeller wash, underwater noise and vibration, and vessel emissions. Potential impacts on cultural resources, water quality, and fish are addressed in Chapter 4, Section 4.4, *Cultural Resources*, and Chapter 5, Sections 5.2, *Surface Water and Floodplains*, 5.5, *Water Quality*, 5.6, *Vegetation*, 5.7, *Fish*, and 5.8, *Wildlife*, respectively. The magnitude of these vessel-related impacts would depend on a variety of interrelated factors, including but not limited to, distance of the channel from the shoreline, depth of the intervening riverbed, placement and size of dredged materials, the presence of particularly sensitive species, the speed and size of the vessels, the prevailing river and tidal currents, and otherwise naturally occurring wave action.

6.4.5.2 Off-Site Alternative

The project area for the Off-Site Alternative is located adjacent (west and downriver approximately 1.5 miles) to the project area for the On-Site Alternative. Vessel docking, undocking, and other activities at the proposed docks (Docks A and B), would be conducted in the same manner and with the same precautions as described for the On-Site Alternative. The same number and type of vessels would be loaded at the Off-Site Alternative location as the On-Site Alternative location. Therefore, vessel impacts of the Off-Site Alternative would be nearly identical to the On-Site Alternative.

Construction—Direct Impacts

Dock construction would occur over a 6-month to 1-year period. For this work, barges would be located near Docks A and B but positioned outside of the navigation channel, so as to not impede vessels traveling within the channel.

Construction—Indirect Impacts

Indirect impacts resulting from construction of the Off-Site Alternative would be the same as those described for the On-Site Alternative.

As described in Chapter 3, *Alternatives*, the Applicant has identified three construction-material-delivery scenarios: delivery by truck, rail, or barge. If material is delivered by barge, it is estimated approximately 1,130 barge trips would be required over the construction period. Approximately two-thirds of the barge trips would occur during the peak construction year, assumed to be 2018. Approximately 750 barge trips in the study area would be required during the peak construction year to deliver construction materials. Because the project area does not have an existing barge dock, the material would be off-loaded at an existing dock elsewhere on the Columbia River and transported to the project area by truck.

Barges are shallower in draft and could transit the Columbia River navigation channel during periods of low water to avoid interference with larger vessel traffic. Coordination would take place with the River Pilots prior to and during transit activity. Moreover, the construction barges would be transiting a portion of the navigation channel during construction in the vicinity of the project area and not the entire study area. Given the limited work area, construction-related barge traffic is unlikely to interfere with larger vessels in the Columbia River navigation channel.

Operations—Direct Impacts

Operation of the Off-Site Alternative would result in the same direct impacts as the On-Site Alternative except as described below. Vessel operations at the Off-Site Alternative would be subject to tidal current and river flows similar to the On-Site Alternative. The Off-Site Alternative location is undeveloped, and there is no vessel operating history or pilot experience for that location. The available data indicate currents along that portion of the river are reasonably consistent and predictable. If river conditions were not suitable for turning off the dock, pilots would be able to turn around departing vessels further upriver at the turning basin shown in Figure 6.4-1.

Operations—Indirect Impacts

Operation of the terminal at the Off-Site Alternative location would result in the same indirect impacts as at the On-Site Alternative location except project-related vessels would not need to travel as far upriver (approximately 1.5 miles less) to reach a terminal at the On-Site Alternative location.

6.4.5.3 No-Action Alternative

Under the No-Action Alternative, the Corps would not issue a Department of the Army permit authorizing construction and operation of the proposed export terminal. As a result, impacts resulting from constructing and operating the export terminal would not occur. In addition, not constructing the export terminal would likely lead to expansion of the adjacent bulk product business onto the On-Site Alternative project area.

The Applicant's planned operations and expansion, would increase vessel traffic by approximately eight vessels per year, as described in Chapter 3, *Alternatives*. Additionally, vessel traffic in the lower Columbia River is expected to increase over time with continued industrial development along the river. As assumed for the incident modeling, large commercial vessel traffic would increase over the analysis period and by 2028 would reach approximately 2,200 vessel trips per year (or approximately 4,400 transits [Table 6.4-11]). Therefore, there would be an increase in the number of incidents likely to occur if the proposed export terminal is not built. As shown in Table 6.4-12, the predicted incident frequency under No-Action conditions would be 19.4 incidents per year, an increase of 2.8 incidents per year over existing conditions.

Management of vessel traffic on the lower Columbia River will be an ongoing concern for federal (USCG and Corps) and state (Ecology and DEQ) agencies, local coastal jurisdictions, the Bar Pilots and River Pilots, maritime associations (such as PDXMEX and MFSA), and private interests even if the proposed export terminal is not constructed. Vessel traffic volume is expected to be variable along the lower Columbia River due to economic and market fluctuations, changes in port infrastructure, and vessel design modifications. The Columbia River VTIS and the Lower Columbia Region Harbor Safety Committee are both part of a system that functions to adapt to changes in the nature and the volume of vessel traffic. These systems and studies are in place and would continue to operate under the No-Action Alternative and help reduce the impacts related to the anticipated increases in vessel traffic in the lower Columbia River.

6.4.6 Required Permits

No permits related to vessel transportation would be required for the proposed export terminal.

6.5 Noise and Vibration

Sound is a fundamental component of daily life. When sounds are perceived as desired, beneficial, or otherwise pleasing, they are typically considered as having a positive effect on daily life. When sounds are perceived as unpleasant, unwanted, or disturbingly loud, they are considered *noise*. Noise may interfere with a broad range of human activities such as communication or sleep. Noise disturbance varies depending on the conditions and on the particular land uses and activities near the sound source and the sensitivity of those land uses.

Vibration is motion described in terms of displacement, velocity, or acceleration. People are usually sensitive to perceptible vibration. An increase in noise or vibration can affect the peacefulness, serenity, and sacredness of residential, commercial, recreational, and cultural locations.

This section describes noise and vibration in the study area. It then describes potential noise and vibration impacts from construction and operation of the proposed export terminal.

6.5.1 Regulatory Setting

Laws and regulations relevant to noise and vibration are summarized in Table 6.5-1.

Table 6.5-1. Regulations, Statutes, and Guidelines for Noise and Vibration

Regulation, Statute, Guideline	Description
Federal	
Noise Control Act of 1972 (42 USC § 4910)	Protects the health and welfare of U.S. citizens from the growing risk of noise pollution, primarily from transportation vehicles, machinery, and other commerce products. Increases coordination between federal researchers and noise-control activities; establishes noise emission standards; and presents noise emission and reduction information to the public.
Federal Transit Administration Transit Noise and Vibration Impact Assessment (FTA-VA-90-1003-06, May 2006)	Provides procedures and guidance for analyzing the level of noise and vibration, assessing the resulting impacts, and determining possible mitigation for most federally funded transit projects.
Federal Railroad Administration High-Speed Ground Transportation Noise and Vibration Impact Assessment (October 2012)	Provides guidance and methods for the assessment of potential noise and vibration impacts resulting from proposed high-speed ground transportation projects.
U.S. Environmental Protection Agency Railroad Noise Emission Standards (2014) (40 CFR 201)	Establishes final noise emission standards for surface carriers engaged in interstate commerce by railroad. This rulemaking is pursuant to Section 17 of the Noise Control Act of 1972.
FRA Railroad Noise Emission Compliance Regulations (49 CFR 210)	Indicates the minimum compliance regulations necessary to enforce EPA's Railroad Noise Emission Standards.

Regulation, Statute, Guideline	Description
FRA Final Rule on the Use of Locomotive Horns at Highway-Rail Grade Crossings (49 CFR 222 and 229)	Requires the sounding of locomotive horns at public highway rail grade crossings. Considers the allowance of Quiet Zones when the increased risk is mitigated with supplementary grade crossing safety measures.
State	
Maximum Environmental Noise Levels (WAC 173-60)	Establishes maximum environmental noise levels. However, noise from surface carriers engaged in interstate commerce by railroad are exempt from these regulations.
Local	
Cowlitz County Code (CCC 10.25) (Nuisance Noises)	Regulates excessive intermittent noise that interferes with the use, value and enjoyment of property and which pose a hazard to the public health, safety, and welfare.

Notes:
USC = United States Code; FTA = Federal Transit Administration; FRA = Federal Railroad Administration; CFR = Code of Federal Regulations; EPA = U.S. Environmental Protection Agency; WAC = Washington Administrative Code; CCC = Cowlitz County Code

6.5.2 Study Area

The study areas for noise and vibration are the same for both the On-Site Alternative and Off-Site Alternative, and were identified using the Corps' NEPA scope of analysis Memorandum For Record (February 14, 2014) and refined to reflect current conditions near the project areas.

The study area for direct impacts is within 1 mile of the project areas. The study area for indirect impacts is the direct impacts study area plus the area within 1 mile from the centerline on the Reynolds Lead and BNSF Spur between Longview Junction and the project area for both the On-Site Alternative and Off-Site Alternative. Figure 6.5-1 illustrates the combined study area.

6.5.3 Methods

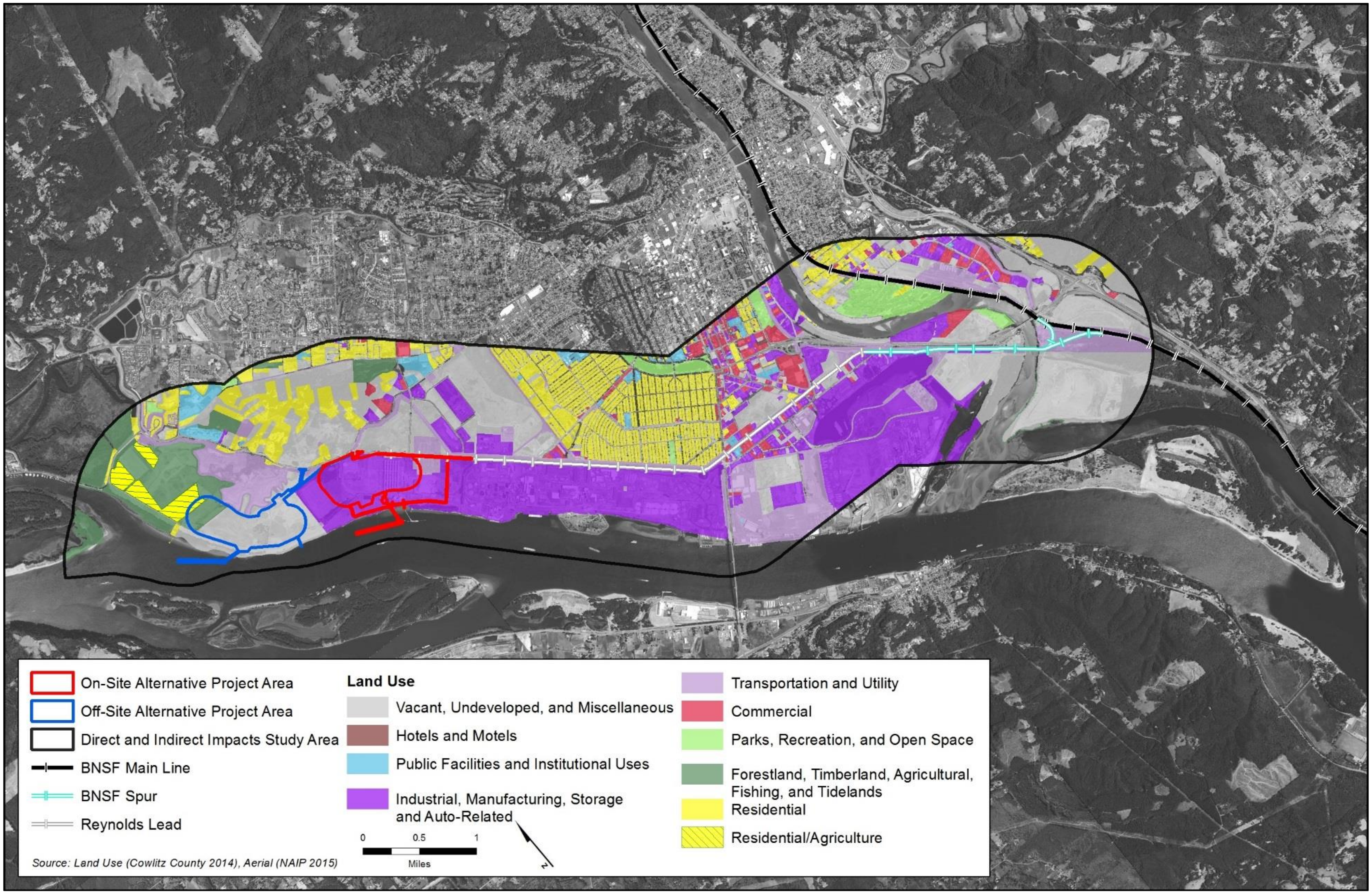
This section describes the sources of information and methods used to evaluate the potential noise and vibration impacts associated with the construction and operation of the proposed export terminal. Methods for field surveys conducted in the study area are also provided.

6.5.3.1 Information Sources

The following sources of information were used to evaluate noise and vibration impacts.

- Information provided by the Applicant, including project design features and a list of typical construction and operation equipment.
- Lists of typical construction and operation equipment from reference projects and typical corresponding noise and vibration levels.
- Existing and future-year rail traffic estimates for the Reynolds Lead and BNSF Spur provided by the Longview Switching Company (LVSW) and the Applicant.
- Data on locomotive and train noise levels.
- Ambient noise monitoring data collected during field surveys in the study area.

Figure 6.5-1. Noise and Vibration Study Area



6.5.3.2 Field Surveys

Field surveys were performed from October 28 through November 10, 2014, and from January 11 through 16, 2015, to measure existing outdoor sound levels (ambient noise levels) at representative noise-sensitive receptors in the study areas. Noise-sensitive receptors include residential and institutional land uses such as schools and churches (Figure 6.5-2). The surveys focused on locations in the study area where noise-sensitive receptors could be exposed to noise from project-related activities. Short-term (10-minute) and long-term (24-hour) sound-level meters were set up for measurements at selected noise-sensitive receptors (Figure 6.5-3).

Four sound-level meters were installed on October 27, 2014, then relocated to another location on November 2, 2014, providing at least 6 full days of data collected at each of the eight long-term ambient noise survey locations shown in Figure 6.5-3. The meters were mounted on utility poles with the microphone approximately 10 feet above the ground surface. Short-term measurements were conducted during the same time period as the long-term survey. The microphone of the short-term equipment was placed 5 feet above ground surface and the noise level was measured and recorded for a period of 10 minutes at each short-term survey location. Figure 6.5-3 illustrates the short-term ambient noise survey locations.

The *NEPA Noise and Vibration Technical Report* (ICF International and Wilson Ihrig 2016) provides additional information on the methods used to obtain existing ambient noise levels.

6.5.3.3 Methods for Impact Analysis

The following methods were used to evaluate the potential impacts of the proposed export terminal on noise and vibration.

Construction

The Applicant has identified three construction scenarios.

- **Truck.** If material is delivered by truck, it is assumed approximately 88,000 truck trips would be required over the construction period. Approximately 56,000 loaded trucks would be needed during the peak construction year.
- **Rail.** If material is delivered by rail, it is assumed approximately 35,000 loaded rail cars would be required over the construction period. Approximately two-thirds of the rail trips would occur during the peak construction year.
- **Barge.** If material is delivered by barge, it is assumed approximately 1,130 barge trips would be required over the construction period. Approximately two-thirds of the barge trips would occur during the peak construction year. Because the project areas for the On-Site Alternative and Off-Site Alternative do not have an existing barge dock, the material would be off-loaded at an existing dock elsewhere on the Columbia River.

The methods for analyzing noise and vibration impacts related to construction are described in this subsection. The *NEPA Noise and Vibration Technical Report* provides additional information on the methods to analyze potential impacts.

Figure 6.5-2. Noise-Sensitive Land Uses in the Study Area

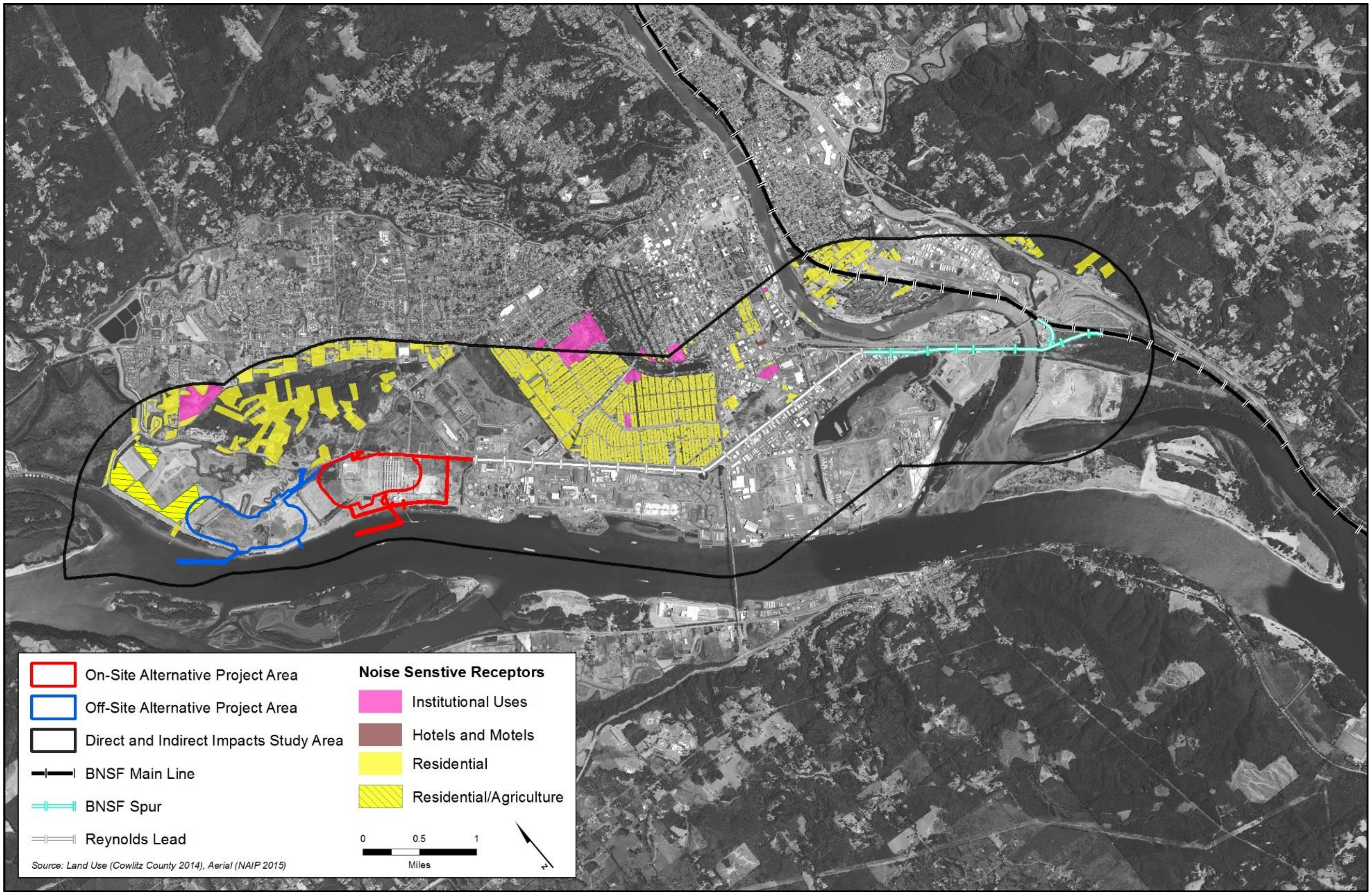
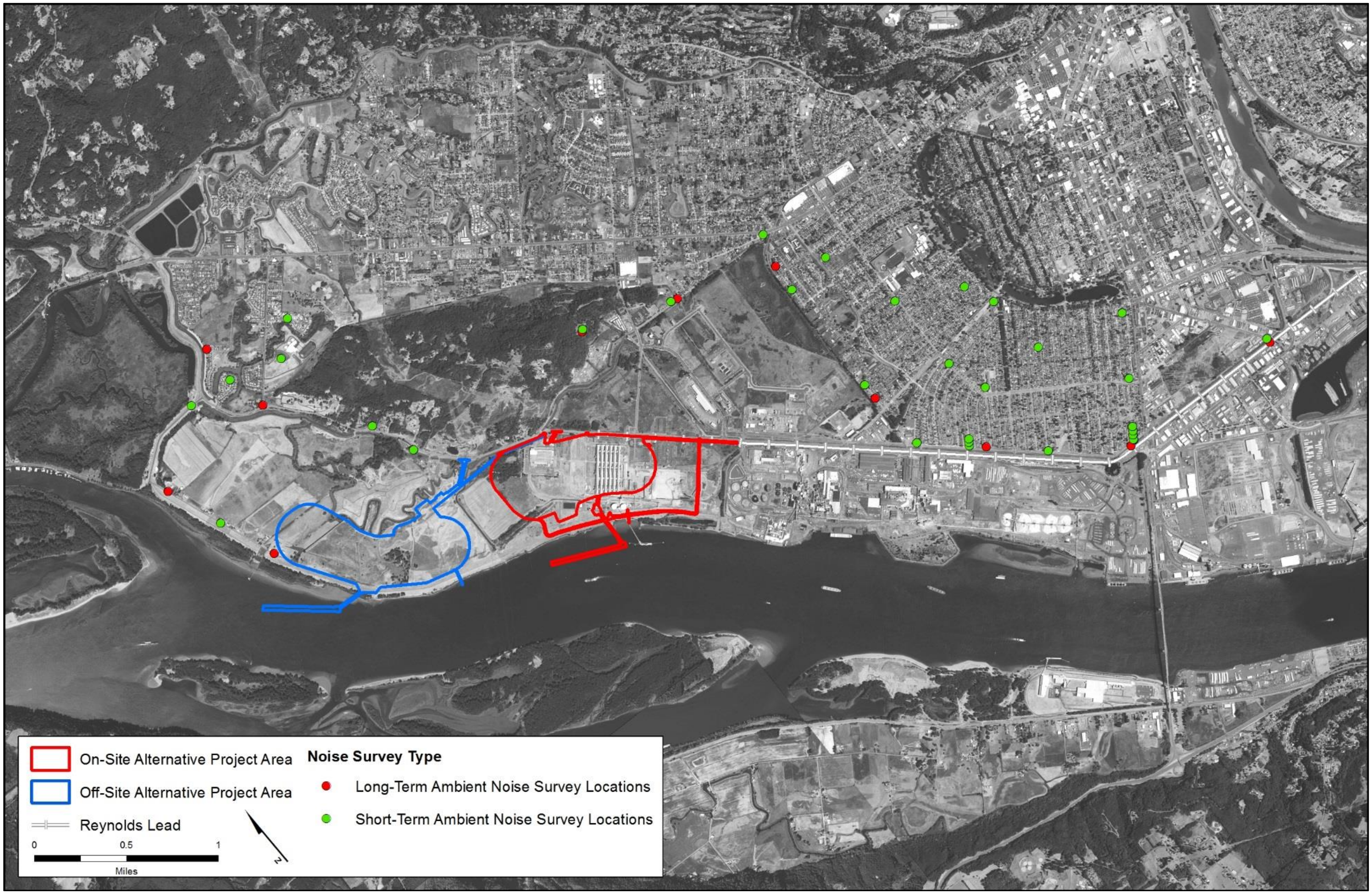


Figure 6.5-3. Ambient Sound Pressure Level Survey Locations



Noise

Construction of the proposed export terminal at either the On-Site Alternative or Off-Site Alternative locations would occur primarily during daytime hours. Daytime construction of the terminal at these locations would be exempt from Washington State permissible noise level regulations (Washington Administrative Code [WAC] 173-60-040). To provide context regarding construction noise levels, construction noise in the project areas was evaluated per guidelines established by the Federal Transit Administration (FTA) (2006) and Federal Railroad Administration (FRA) (2012). Construction noise, including pile-driving, which is typically the most dominant source of noise complaints during construction, was estimated at the noise-sensitive receptors in the study area using detailed information about the anticipated roster of construction equipment to be used and based on information provided by the Applicant. For purposes of this analysis, and because the exact locations of construction equipment and processes are either unknown at this time or could vary during the course of construction, noise was treated as originating from the acoustic center of the geographic locations. An assessment of potential indirect noise impacts from project-related construction trains and vehicle traffic was also performed.

Vibration

Pile-driving would be the dominant source of ground vibration during construction. Vibration during pile-driving was calculated using the methods from *Transit Noise and Vibration Impact Assessment* (Federal Transit Administration 2006). Human annoyance can occur at much lower vibration levels than vibration levels causing cosmetic damage to structures. Therefore, this lower "annoyance" threshold was used to assess vibration impacts.

Operations

The methods for analyzing noise and vibration impacts related to operations are described in this subsection.

Direct Impacts

The following describes the methods to evaluate potential noise and vibration impacts in the project areas.

Noise

The Computer-Aided Noise Abatement Noise Prediction Model (Cadna/A®, Version 4.4.145) was used to estimate the propagation of sound from operation of the terminal in the project areas. The model predicted noise levels at noise-sensitive receptors in the study areas and generated noise contours (lines of equal noise levels) for comparison to the Washington State regulatory noise criteria.[1] The *NEPA Noise and Vibration Technical Report* provides the list of sound sources included in the model and the parameters and assumptions for each noise source, equipment sound levels, and other assumptions. The equipment analyzed included transfer towers, conveyor belts, conveyor drives, a tandem rotary dumper, shiploaders, stacker/reclaimers, surge bins and the rail loop. The model parameters and assumptions considered buildings and structures, coal storage piles, surface

[1] Cadna/A® considers natural and human-made topographical barrier effects, including terrain features and structures such as major buildings, storage tanks, and large equipment.

acoustical absorption, foliage, temperatures and relative humidity and cladding for exterior surfaces.

Vibration

There would be no substantial sources of ground vibration in the project area for the On-Site Alternative and Off-Site Alternative during operations, except trains moving on the rail loop in the project area. Using data and methods provided in *Transit Noise and Vibration Impact Assessment* (Federal Transit Administration 2006), it was determined vibration from train operations is unlikely at distances greater than 40 feet from a railroad track for infrequent events (less than 30 trains per day). The closest vibration-sensitive receptor (a residence) is approximately 275 feet from the outer track of the rail loop. Therefore, an estimate of vibration generated during operation of the terminal operations was not necessary.

Indirect Impacts

The following describes the methods to evaluate potential noise and vibration impacts from project-related rail and vessel traffic.

Rail Traffic Noise

As described in Section 6.1, *Rail Transportation*, LVSW plans to upgrade the Reynolds Lead and part of the BNSF Spur as a separate action should it be warranted by increased rail traffic resulting from existing and future customers. This analysis assessed rail noise with planned track improvements and without track improvements.

A noise model was used to predict noise levels generated by rail traffic along the Reynolds Lead and BNSF Spur for existing conditions, the No-Action Alternative in 2018, the No-Action Alternative in 2028, and the On-Site Alternative and Off-Site Alternative in 2028. Section 6.1, *Rail Transportation*, describes rail traffic volumes on the Reynolds Lead and BNSF Spur assumed for these scenarios. The model assumed continuously welded rail, consistent with the existing rail on the Reynolds Lead and BNSF Spur.

The analysis considered two types of rail noise.

- *Wayside noise*, which refers to the combined effect of locomotive noise and car/wheel noise.
- *Horn noise*, which refers to the sound of locomotive warning horns sounded at public at-grade road/rail crossings. In addition, LVSW operating rules require train engineers to sound locomotive horns at private at-grade crossings on the Reynolds Lead. Because horn sounding is intentionally loud to warn motorists of oncoming trains, the horn noise footprint is often larger than the wayside noise footprint.

There are five public at-grade crossings and three active private crossings along the Reynolds Lead and BNSF Spur.

- Dike Road
- 3rd Avenue
- California Way
- Oregon Way
- Industrial Way

- Weyerhaeuser entrance west of Douglas Street (private crossing)
- Weyerhaeuser entrance at Washington Way (private crossing)
- 38th Avenue entrance to the Applicant's existing bulk product terminal (private crossing)

The noise model included the FRA provision for train horn sounding not less than 15 seconds or more than 20 seconds before the locomotive reaches an at-grade crossing. To be conservative, the analysis assumed locomotive horn sounding would begin 20 seconds before the locomotive reaches an at-grade crossing. The noise levels were predicted for trains running both with and without sounding horns at crossings.

Noise from surface carriers engaged in interstate commerce by railroad is exempt from Washington State maximum permissible noise level regulations (WAC 173-60-040). Therefore, there are no criteria or guidelines for assessing noise impacts specifically from freight trains, and high-speed rail and transit project impact guidelines were determined to represent the most appropriate measure.

FRA-adopted noise assessment methods developed by FTA were used to calculate potential noise impacts from operations of the terminal at the On-Site Alternative and Off-Site Alternative locations. These methods are documented in the *Transit Noise and Vibration Impact Assessment* (FTA/FRA guidance) (Federal Transit Administration 2006). FRA generally relies on this guidance for analysis of potential noise impacts from conventional rail vehicles traveling at speeds below 90 miles per hour (Federal Railroad Administration 2012).

To supplement FTA/FRA guidance, freight rail source levels from the FRA *High Speed Ground Transportation Noise and Vibration Assessment* were used to characterize noise from freight rail vehicles (Federal Railroad Administration 2012). These guidelines determine noise impacts based on increases in ambient noise level (day-night sound level [L_{dn}][2] or peak hour equivalent sound level [L_{eq}],[3] depending on the type of receptor) after a project is completed. The acceptable increase depends on the existing ambient noise level.

FTA/FRA guidance noise impact criteria are based on the land use category receiving the noise. The FTA/FRA guidance identifies three land use categories for assessing potential noise impacts.[4]

- **Category 1.** Tracts of land where quiet is an essential element of their intended purpose, such as outdoor amphitheaters, concert pavilions, and national historic landmarks with significant outdoor use.
- **Category 2.** Residences and buildings where people normally sleep, including homes, hospitals, and hotels.
- **Category 3.** Institutional land uses (schools, places of worship, libraries) typically available during daytime and evening hours. Other uses in this category can include medical offices, conference rooms, recording studios, concert halls, cemeteries, monuments, museums, historical sites, parks, and recreational facilities.

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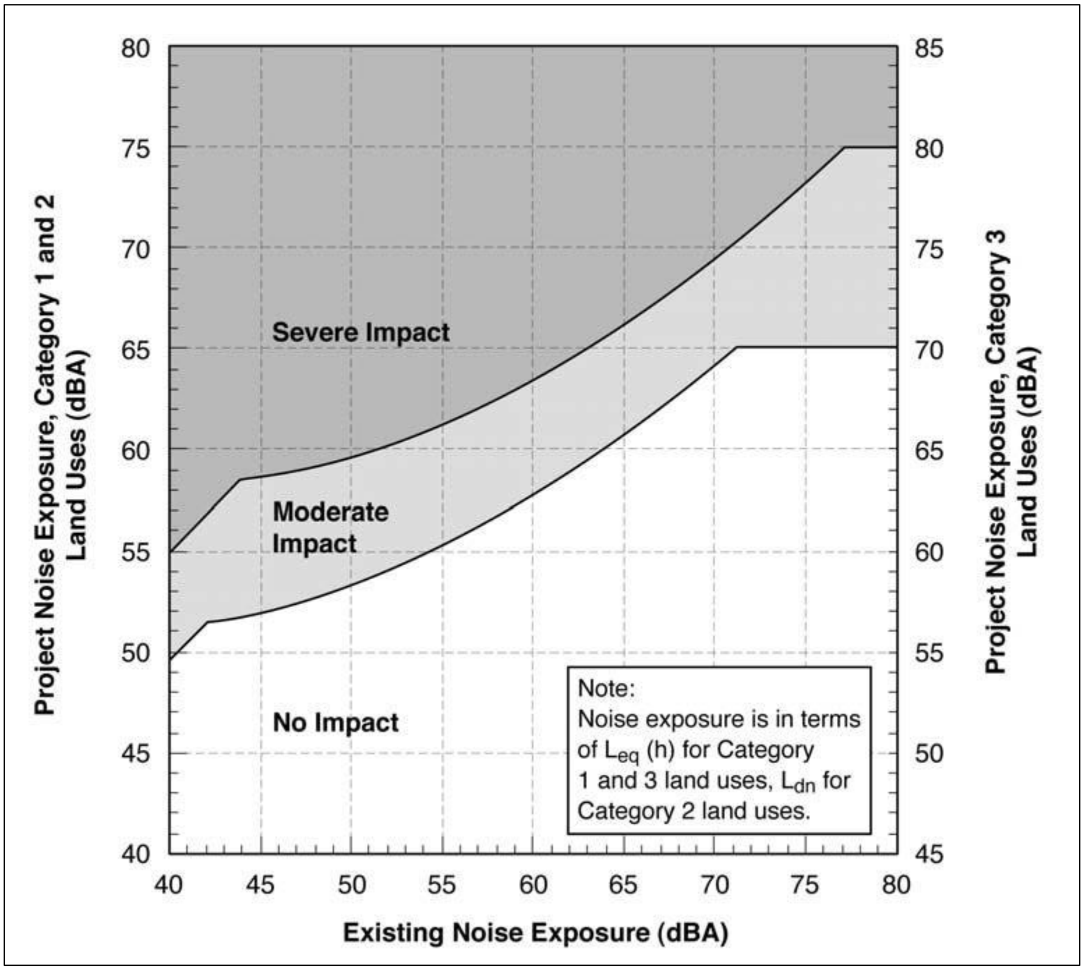
[2] The day-night sound level (Ldn) is essentially a 24-hour average noise level (in A-weighted decibels [dBA]) with a 10-decibel upward adjustment of noise levels occurring at night. This adjustment is made to account for most peoples' increased sensitivity to noise at night.
[3] The $L_{eq(h)}$ a noise metric representing a constant sound level containing the same sound energy as the actual fluctuating sound over an hour. As such, the L_{eq} can be considered an energy-average sound level.
[4] Noise exposure values are reported as hourly equivalent sound level ($L_{eq[h]}$) for Category 1 and 3 land uses, and L_{dn} for residential land uses (Category 2).

The FTA/FRA guidance defines three noise impact category levels (Figure 6.5-4).

- **No impact.** The change in the noise level would result in an insignificant increase in the number of instances where people are highly annoyed by new noise.
- **Moderate impact**. The change in the noise level would be noticeable to most people but may not be enough to cause strong adverse community reactions.
- **Severe impact.** A significant percentage of people would be highly annoyed by the noise.

Figure 6.5-4. Noise Impact Criteria



Source: Federal Transit Administration 2006.

The level of impact is determined by the existing level of noise exposure and the change in noise exposure using a sliding scale according to the land uses affected. As the existing level of noise exposure increases, the additional noise exposure needed to cause a moderate or severe impact decreases. The contribution of project-related trains relative to the existing noise levels would differ according to the level of existing noise exposure (Figure 6.5-4). This sliding scale recognizes people who are already exposed to high levels of noise in the ambient environment are expected to tolerate smaller increases in noise in their community relative to locations with lower existing ambient levels. The increases between the On-Site Alternative and Off-Site Alternative in 2028 and the No Action 2028 levels were compared to the FTA/FRA guidance to determine the level of noise impact.

Rail Traffic Vibration

Using generalized ground surface vibration curves (Federal Transit Administration 2006) and correcting for speed, vibration from project-related train operations would be unlikely at distances greater than 40 feet from a railroad track for infrequent events (less than 30 passbys per day). The closest vibration-sensitive receptor (a residence) is approximately 150 feet away from the Reynolds Lead, and there are no vibration-sensitive receptors adjacent to the BNSF Spur. Therefore, no analysis was conducted to estimate vibration from rail operations.

Vessel Traffic Noise

The general assumptions used to assess impacts from stationary and moving vessels on the Columbia River are presented in Table 6.5-2.

Table 6.5-2. Assumptions Related to Noise from Stationary and Moving Vessels

Equipment	Noise level
Stationary vessels (moored ship)	65 dBA at a distance of 62 feet
Vessels under way	45 dBA at a distance of 400 feet
Foghorns	60 dBA at a distance of 1,800 feet

Notes:
See the *NEPA Noise and Vibration Technical Report* for detailed information on the sources of these noise level assumptions.
dBA = A-weighted decibel

Vessel Traffic Vibration

No analysis was conducted to estimate vibration generated during vessel operations. Project-related vessels would be similar to those already traveling on the Columbia River. There have been no documented cases of perceptible vibration onshore generated by ship traffic on the river.

6.5.4 Affected Environment

This section describes the affected environment related to noise and vibration potentially affected by the construction and operation of the proposed export terminal.

Figure 6.5-1 illustrates the land uses in the study area. Figure 6.5-2 illustrates the noise-sensitive receptors in the study area, including residential land uses. The closest noise-sensitive receptors to the project areas, Reynolds Lead, and BNSF Spur are residential land uses. These land uses are generally located north of the Reynolds Lead and Industrial Way (State Route [SR] 432) between Oregon Way and Washington Way (a distance of approximately 1.5 miles along the Reynolds Lead), with some residential land uses near the California Way and 3rd Avenue crossings of the Reynolds Lead.

As described in Section 6.5.3, *Methods,* long- and short-term surveys were conducted to determine existing conditions in the study area. Primary noise sources during the surveys varied by location, but were generally observed to include train traffic; vehicle road traffic; noise from existing industrial facilities, mills, and plants; residential activities; and noise from port activities. Table 6.5-3 provides a summary of the primary noise sources at the long-term ambient noise survey locations illustrated in Figure 6.5-3.

Table 6.5-3. Primary Noise Sources at Long-Term Ambient Noise Survey Locations

Long-Term Ambient Noise Survey Location	Noise Sources
602 California Way	California Way and Industrial Way vehicle traffic Trains on the Reynolds Lead Horizon Metals recycling center on California Way
111 15th Avenue	Industrial Way vehicle traffic Trains on the Reynolds Lead
221 Beech Street	Local vehicle traffic Industrial Way vehicle traffic Weyerhaeuser mill Trains on the Reynolds Lead
875 34th Avenue	Local vehicle traffic and residential activity PNW Metal Recycling at Mint Farm Industrial Park
3600 Memorial Park	Local vehicle traffic PNW Metal Recycling at Mint Farm Industrial Park
420 Rutherglen Drive	Distant industrial operations at Mint Farm Industrial Park Weyerhaeuser mill Port of Longview
4723 Mt. Solo Road	Vehicle traffic on Mt. Solo Road
1719 Dorothy Avenue	Local vehicle traffic and residential activity PNW Metal Recycling at Mint Farm Industrial Park
275 Barlow Point Drive	Birds, infrequent vehicle traffic, vessel noise including foghorns
149 Barlow Point Drive	Birds, vehicle traffic, vessel noise
Mount Solo Road	Vehicle traffic
1945 Schneiter Drive	Vehicle traffic

Notes:
See the *NEPA Noise and Vibration Technical Report* for additional information on the noise field surveys.

Figure 6.5-5 illustrates existing noise level contours for all noise sources. The existing ambient noise levels formed the baseline against which the impacts of the proposed export terminal were measured.

Figure 6.5-5a. Existing Rail Noise Contours, BNSF Spur to Reynolds Lead, Including Train Horns

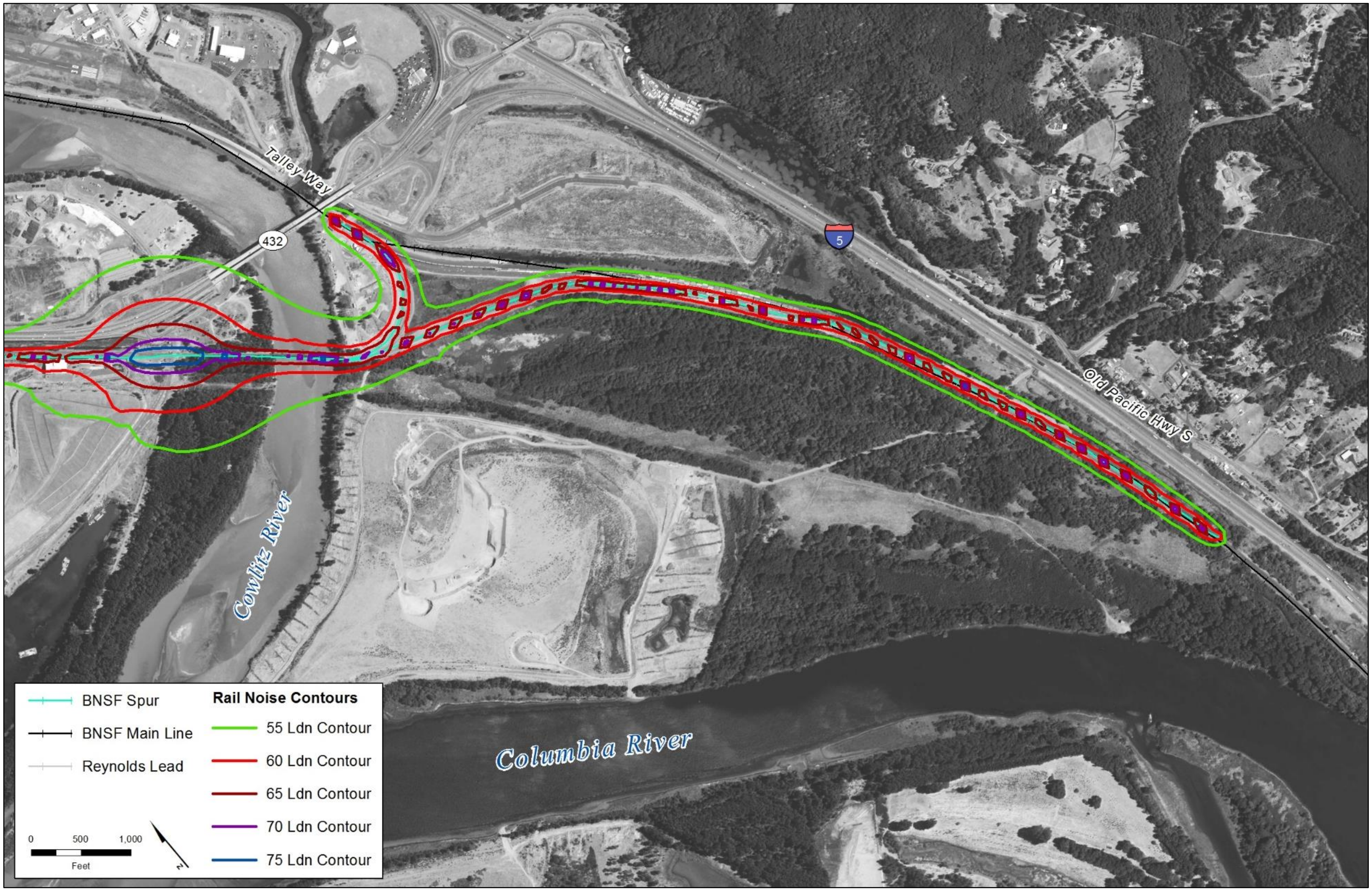


Figure 6.5-5b. Existing Rail Noise Contours, Beginning of Reynolds Lead, Including Train Horns

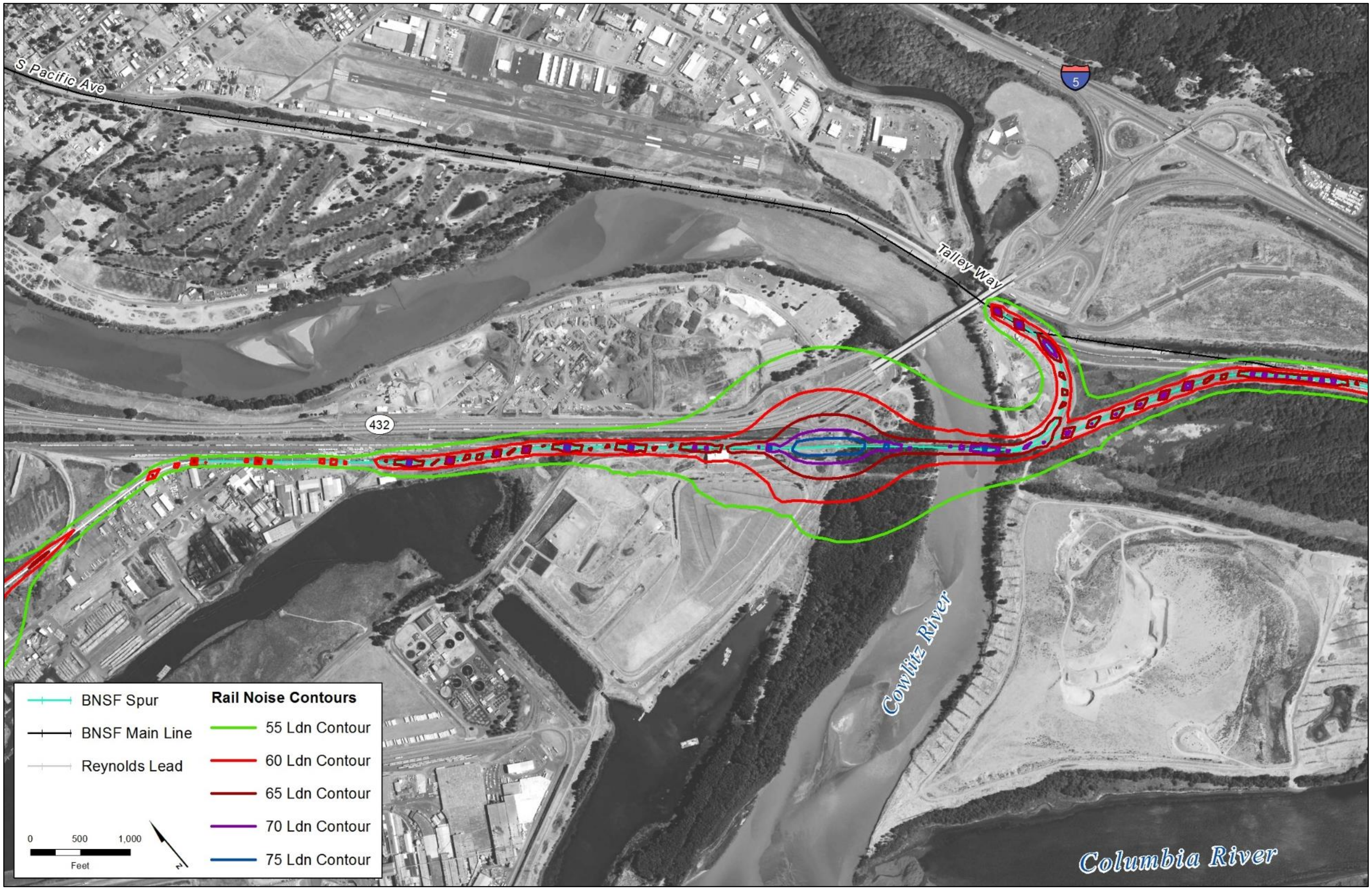
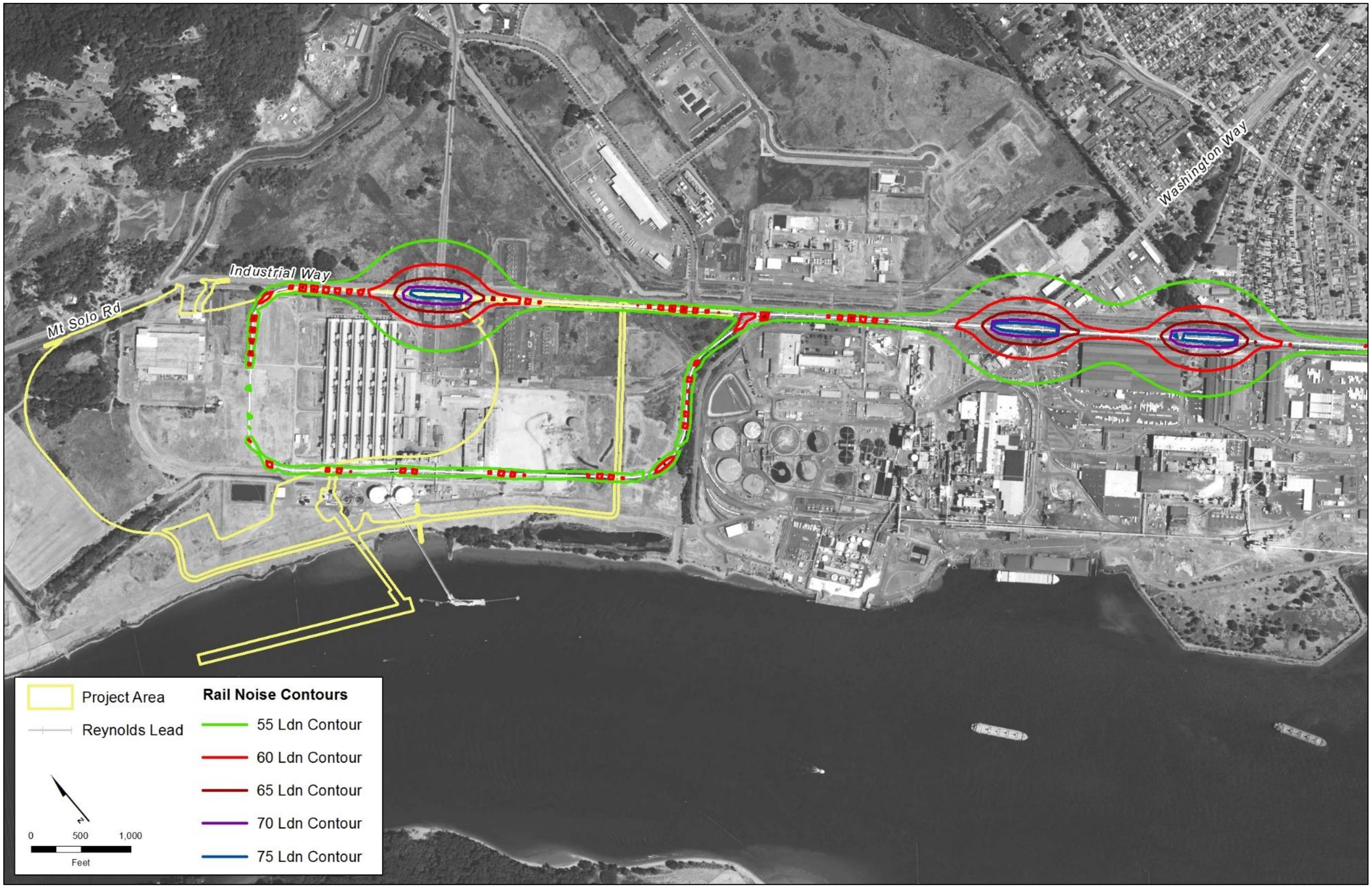


Figure 6.5-5c. Existing Rail Noise Contours, Mid-Reynolds Lead, Including Train Horns

Figure 6.5-5d. Existing Rail Noise Contours, End of Reynolds Lead, Including Train Horns



6.5.5 Impacts

This section describes the potential direct and indirect impacts related to noise and vibration from construction and operation of the proposed export terminal.

6.5.5.1 On-Site Alternative

Construction—Direct Impacts

Construction-related activities associated with the proposed export terminal at the On-Site Alternative location could result in direct impacts as described below.

Noise

The maximum noise level at the closest noise-sensitive receptor (the residence at 104 Bradford Place) would be 83 A-weighted decibels (dBA), which would occur during pile-driving. While not a regulatory noise standard for construction noise, to provide context, this noise level would exceed FTA/FRA noise-level criteria of 80 dBA for construction noise. Noise levels would not exceed 80 dBA at any other times during construction when there is no pile-driving, or when pile-driving is taking place approximately 1,500 feet from this residence.

Vibration

The maximum predicted vibration levels at the closest vibration-sensitive receptor (the residence at 104 Bradford Place) would be 72 velocity decibels during pile-driving. While not a regulatory standard for vibration during construction, to provide context, this vibration level would not exceed FTA/FRA criteria for vibration from construction at residences. Vibration from pile-driving would be not be substantial enough to have an adverse impact at the nearest residence.

Construction—Indirect Impacts

Construction of the terminal at the On-Site Alternative location would result in the following indirect impacts.

Vehicle Traffic Noise

Vehicles traveling to and from the project area, mainly on Industrial Way, represent a potential source of noise impacts during construction. A maximum of approximately 330 truck trips per day for the truck and barge construction material delivery scenarios would be required during the peak year of construction. The increase in truck traffic represents an increase of 3.3% in average daily traffic for all vehicles on Industrial Way. This increase in vehicular traffic would not result in a substantial change to the existing noise levels and would be temporary (during the peak year of construction). Therefore, terminal-related construction traffic would not result in an adverse noise impact.

Rail Traffic Noise

As described in Section 6.1, *Rail Transportation*, the terminal would add an average of 1.3 train trips during the peak construction year if construction materials are delivered by rail. Chapter 3, *Alternatives*, describes the construction scenarios. This level of rail activity would not cause noise levels to increase more than 3 L_{dn} (dBA). Terminal-related rail traffic would not result in noise level increases exceeding applicable criteria for a moderate or severe noise impact as illustrated in Figure 6.5-4.

Operations—Direct Impacts

Operation of the terminal at the On-Site Alternative location would result in the following direct impacts. Operations-related activities are described in Chapter 3, *Alternatives*.

Noise

Figure 6.5-6 shows the predicted noise contours for operation of the terminal at the On-Site Alternative location. Noise from export terminal operations is projected to exceed the Washington State noise standard at one residence (104 Bradford Place). The residence where the exceedance would occur is within the 50-dBA contour, which is the applicable Washington State limit for nighttime noise levels in a residential area when the noise is from an industrial source. The predicted noise level at the residence is 55 dBA, which is comparable to the current nighttime noise level at this location. Other residences are located outside the noise level limit contours or would be shielded by topography.

Vibration

As described in Section 6.5.3, *Methods*, no vibration impacts associated with operation of the terminal at the On-Site Alternative location are anticipated. No substantial sources of ground vibration would occur at the project area during operations, and the closest vibration-sensitive receptor (a residence) is too far away to be affected by vibration from trains on the rail loop in the project area.

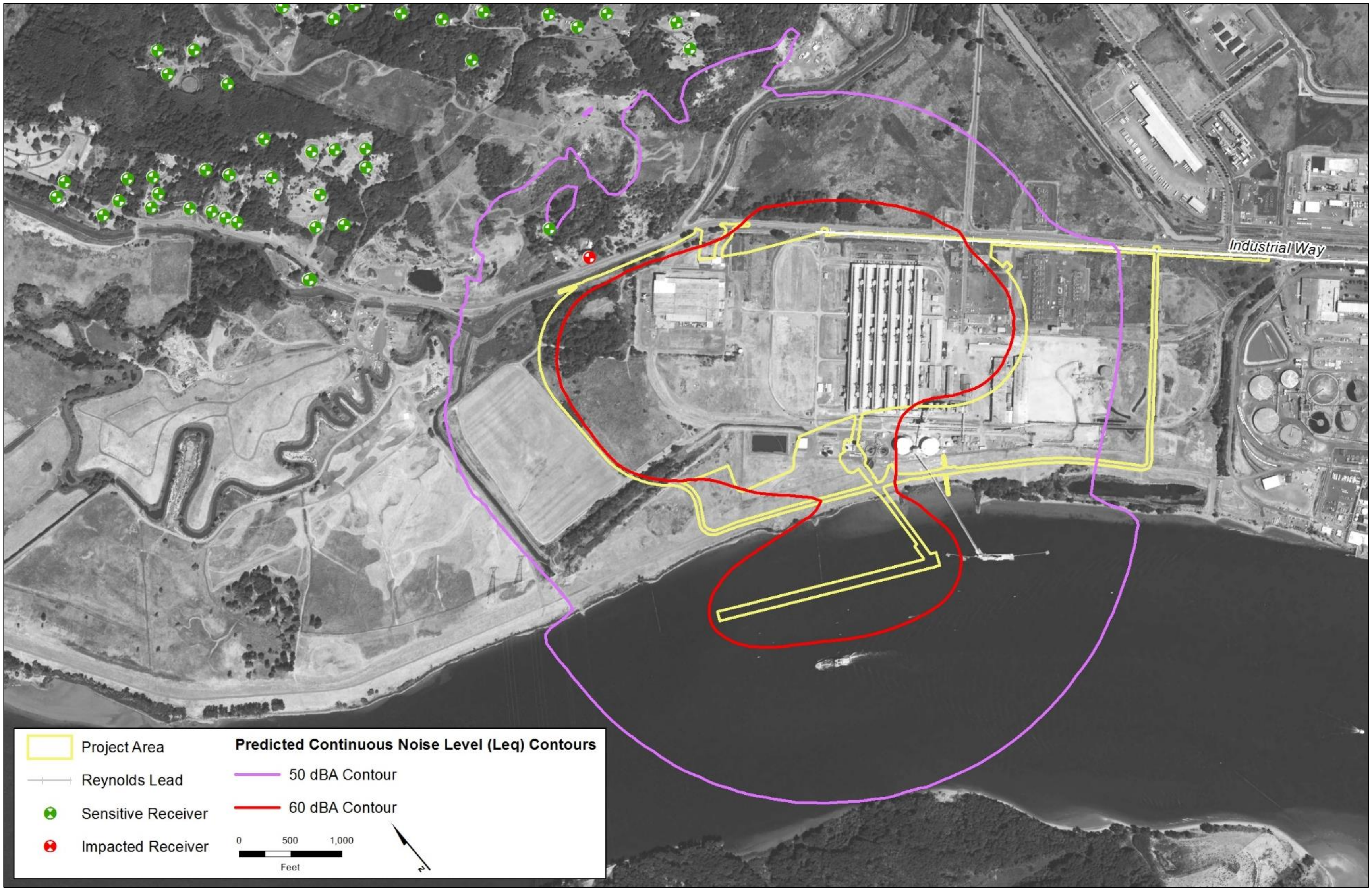
Operations—Indirect Impacts

Operation of the terminal at the On-Site Alternative location would result in the following indirect impacts. Operations-related activities are described in Chapter 3, *Alternatives*.

Vehicle Traffic Noise

Vehicles traveling to and from the project area, mainly on Industrial Way, represent a potential source of noise impacts during operations. As illustrated in Section 6.3, *Vehicle Transportation*, the annual average daily traffic on Industrial Way would increase approximately 5.7% under the On-Site Alternative. In general, a doubling of average daily traffic would be required to increase the L_{dn} from vehicular traffic by 3 dBA at the noise-sensitive receptors. In general, changes in a noise level of less than 3 dBA—as would be expected from the increase in traffic under the On-Site Alternative—would not be noticed by the human ear. Therefore, no noise-related indirect impacts from operations would be expected.

Figure 6.5-6. Predicted Continuous Noise Level (L_{eq}) Contours during Operations of the On-Site Alternative



Rail Traffic Noise

At full operations, the terminal would add 16 trains daily on the Reynolds Lead and BNSF Spur (8 loaded and 8 empty trains). Operation of the terminal would increase rail traffic-related noise along the Reynolds Lead and BNSF Spur primarily as a result of sounding train horns for public safety.

Figure 6.5-7 illustrates plots of the estimated equal noise levels (L_{dn}) with project-related rail traffic in 2028. The noise level contours include the noise from train horns sounded for public safety. Train engineers are required by FRA rules to sound locomotive horns at least 15 seconds, and not more than 20 seconds, in advance of public at-grade crossings. In addition, LVSW operating rules require train engineers to sound locomotive horns at private at-grade crossings. These sounding of horns would occur with or without track improvements on the Reynolds Lead and BNSF Spur that would allow higher train speed through the grade crossings.

Potential noise impacts were based on levels of potential impact (moderate impact or severe impact) defined in FTA/FRA guidance, which compares the existing level of noise exposure to the change in noise exposure with project-related trains. Table 6.5-4 summarizes the predicted number of affected noise-sensitive receptors exposed to moderate and severe impacts.[5] Figure 6.5-8 illustrates the residential land uses that would be exposed to moderate or severe noise impacts.

[5] The number of single residential units that could be affected at each multifamily residence was estimated using online satellite and street photography.

Figure 6.5-7a. Noise Contours with On-Site Alternative 2028 Rail Traffic, BNSF Spur to Reynolds Lead, Including Train Horns

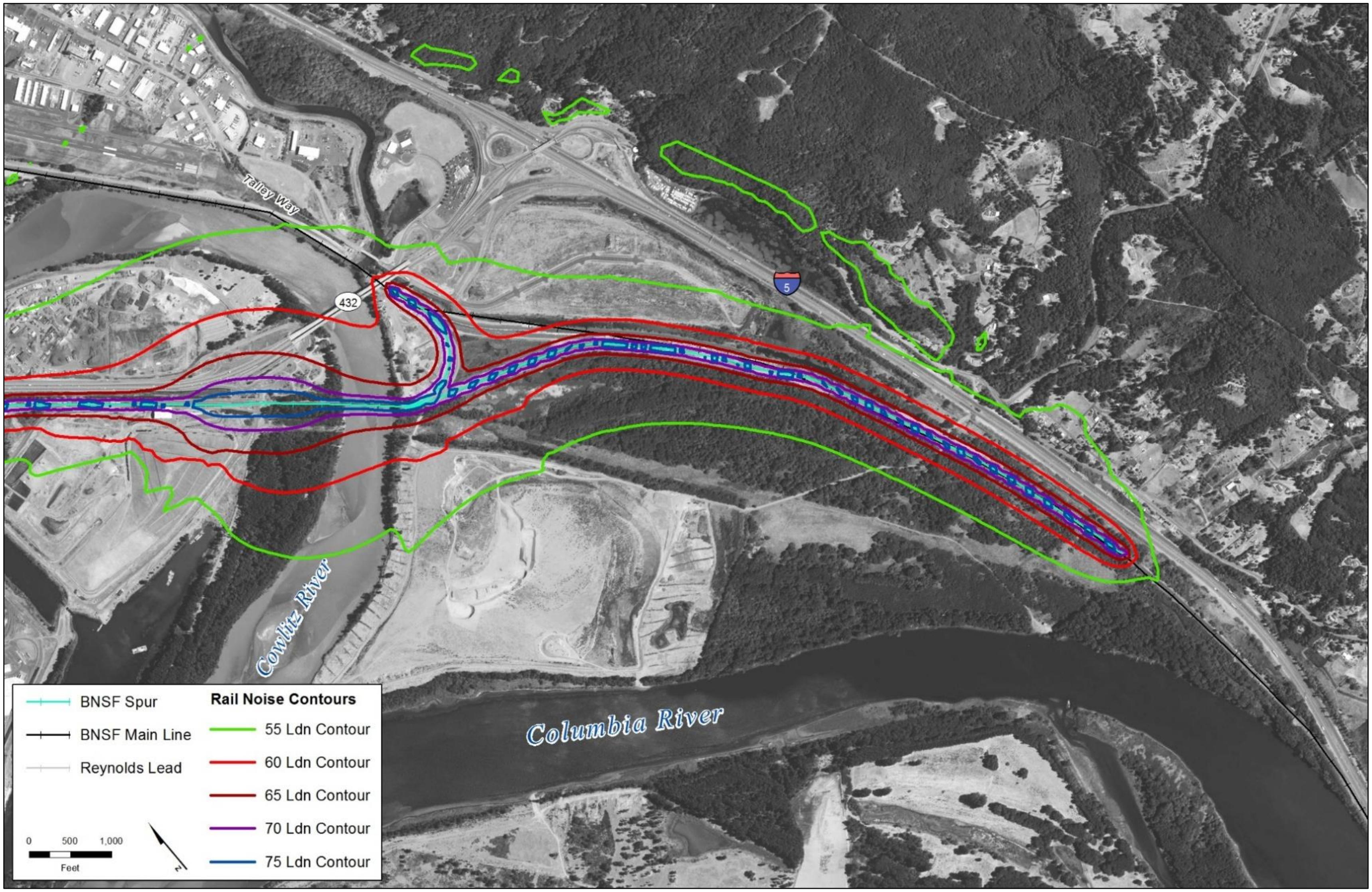


Figure 6.5-7b. Noise Contours with On-Site Alternative 2028 Rail Traffic, Beginning of Reynolds Lead, Including Train Horns

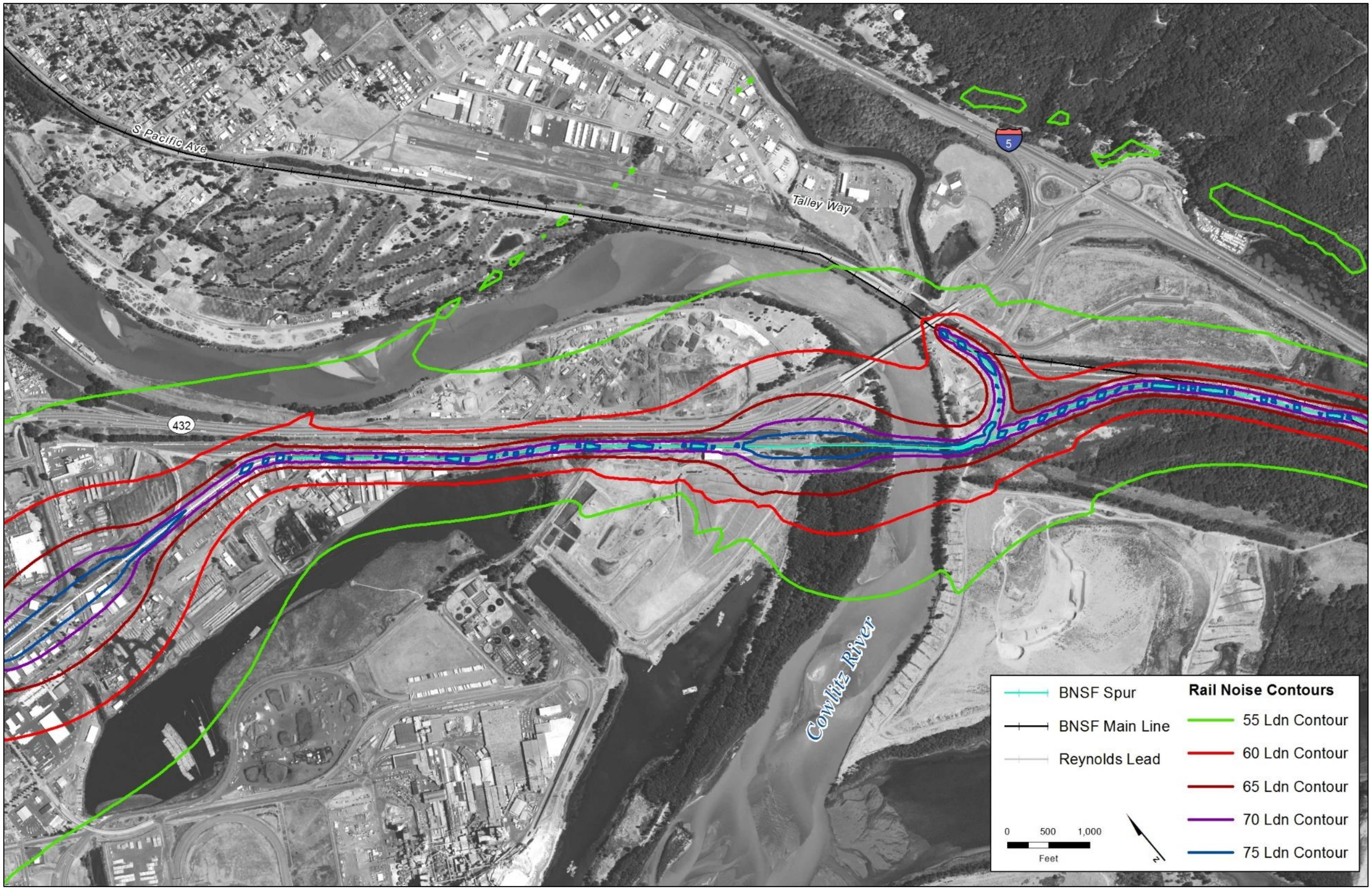


Figure 6.5-7c. Noise Contours with On-Site Alternative 2028 Rail Traffic, Mid-Reynolds Lead, Including Train Horns

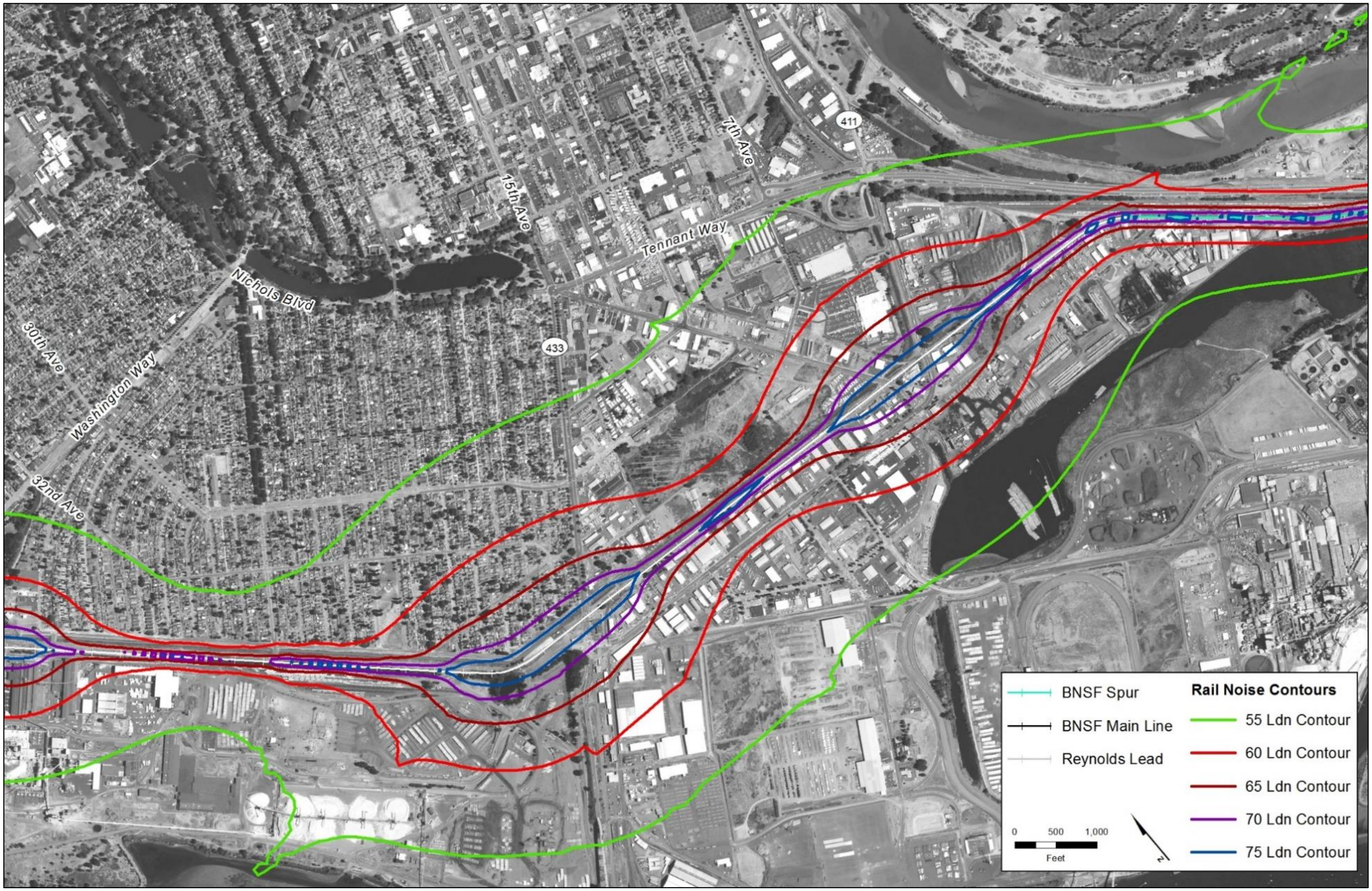


Figure 6.5-7d. Noise Contours with On-Site Alternative 2028 Rail Traffic, End of Reynolds Lead, Including Train Horns

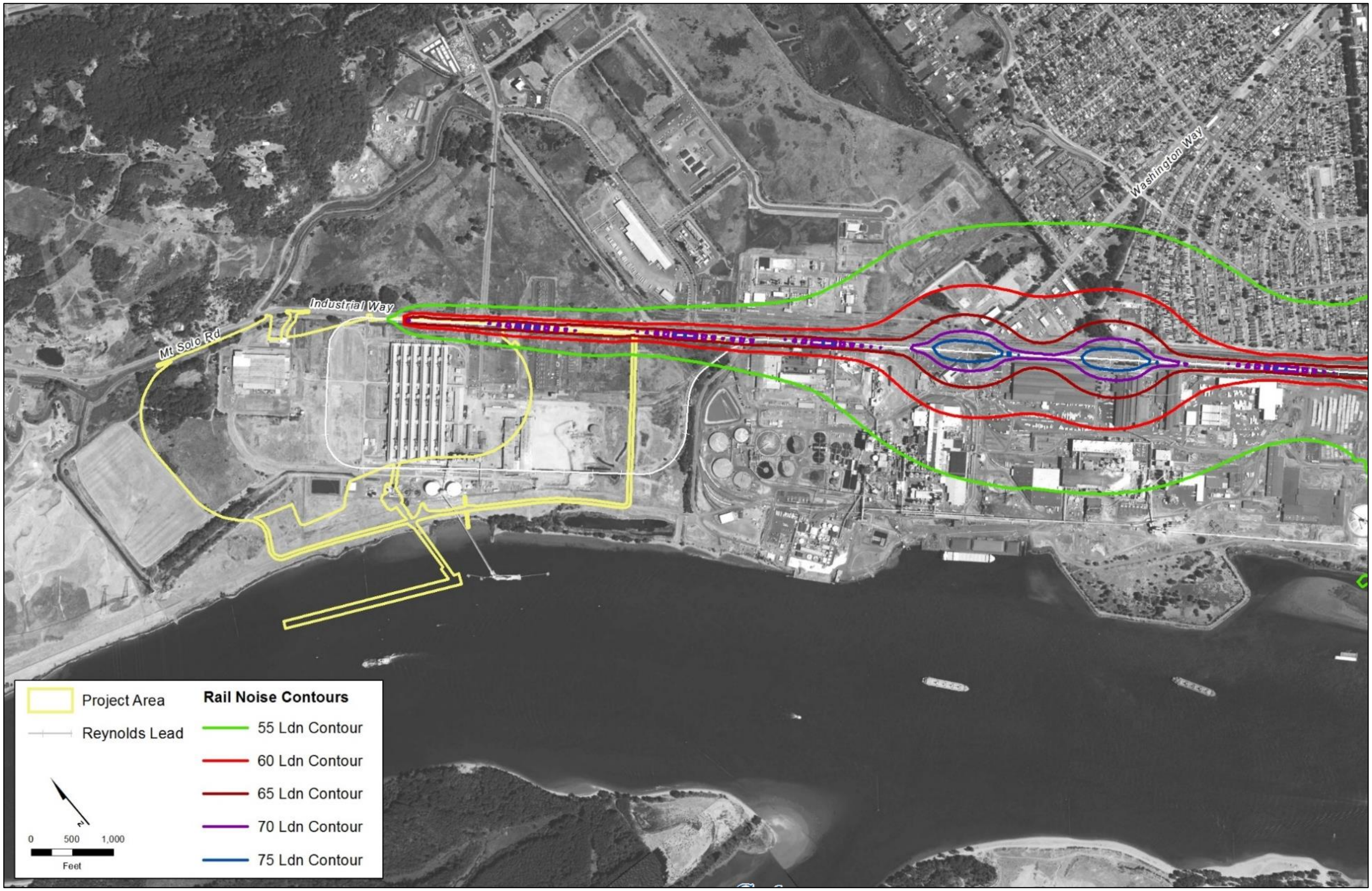


Table 6.5-4. Estimated Number of Noise-Sensitive Receptors Affected by Project-Related Trains

Reynolds Lead Crossing(s)	Estimated Number of Receptors Impacted	
	Moderate Noise Impact	**Severe Noise Impact**
3rd Avenue & California Way	34 mobile homes	10 mobile homes
Oregon Way & Industrial Way	2 mobile homes 133 single-family 18 multifamily[b]	34 single family 5 multifamily[d]
Private driveway at Weyerhaeuser (near Douglas Street & Industrial Way)	4 single family 2 multifamily[c]	0
Total Receptors	**193**	**49**

Notes:
[a] Per FTA/FRA guidance as described in Section 6.5.3, *Methods*.
[b] Estimated 52 individual residences affected.
[c] Estimated 4 individual residences affected.
[d] Estimated 16 individual residences affected.

As shown in the Table 6.5-4, an estimated 193 receptors representing approximately 229 residences would be exposed to a moderate noise impact, and an estimated 49 receptors representing approximately 60 residences would be exposed to a severe noise impact with project-related trains. These impacts would be the same with or without the track improvements to the Reynolds Lead because the train noise would be dominated by the locomotive horn sounding at grade crossings. Project-related trains without horn sounding would not result in noise impacts for train speeds at 10 or 20 miles per hour on the Reynolds Lead.

Vessel Operations Noise

The terminal would load 70 vessels per month or 840 vessels per year. This equates to 1,680 vessel transits in the Columbia River. Noise from terminal-related vessels would not cause a noise impact at noise-sensitive receptors. For vessels moored at the project area docks (Docks 2 and 3), the noise associated with stationary vessels is estimated to be 29 dBA at the closest noise-sensitive receptors on Mt. Solo Road, approximately 3,800 feet from the docks in the project area. This estimated project-related vessel noise would be comparable to or less than ambient noise levels at the closest noise-sensitive receptors.

Terminal-related vessel traffic is comparable to or less than existing noise levels, and is unlikely to cause noise impacts along the Columbia River. For vessels under way in the Columbia River, vessel traffic is expected to be 70 ships per month during full operation in 2028. This corresponds to an average of 4.7 vessel transits per day. The noise-sensitive receptors on Barlow Point Road are all more than 400 feet from the edge of the Columbia River. The anticipated typical minimum distance between these closest receptors and the vessels would be about 1,600 feet. The 32 L_{dn} experienced by these closest noise-sensitive receptors would be comparable or less than existing noise levels.

Figure 6.5-8. Noise-Sensitive Receptors Predicted to be Exposed to Moderate and Severe Noise Impacts

Table 6.5-5 summarizes the potential L_{dn} from project-related vessel traffic in 2028 at various perpendicular distances from the Columbia River navigational channel. Overall, the estimated noise exposure from project-related vessel traffic would be comparable to or less than ambient noise levels at noise-sensitive receptors and is unlikely to cause noise impacts along the Columbia River.

Table 6.5-5. Potential Noise Exposure Levels from Vessel Traffic at Various Perpendicular Distances from the Columbia River Navigational Channel

Distance (feet)	L_{dn}
400	44
600	40
800	38
1000	36
1200	34
1400	33
1600	32

Noise from foghorns is infrequent and is not expected to cause noise impacts at the noise-sensitive receptors. A foghorn recorded from Barlow Road sounded for approximately 4 seconds every 2 minutes and achieved a maximum noise level of 60 dBA at its point of closest approach to the measurement location (approximately 1,800 feet). These noise levels represent the highest foghorn sound levels to which noise-sensitive receptors on Barlow Point Road are exposed. In addition, with the exception of one noise-sensitive receptor, the levee that runs between the Columbia River and Barlow Point Road serves to some extent as a sound barrier.

6.5.5.2 Off-Site Alternative

This section describes the potential impacts in the study area as a result of construction and operation of the proposed export terminal at the Off-Site Alternative location.

Construction—Direct Impacts

Construction-related activities associated with the export terminal at the Off-Site Alternative location could result in direct impacts as described below.

Noise

The maximum noise level at the closest noise-sensitive receptor (the residence at 104 Bradford Place) would be 83 A-weighted decibels (dBA), which would occur during construction to extend the Reynolds Lead. While not a regulatory noise standard for construction noise, to provide context, this noise level would exceed the FTA/FRA noise-level criterion of 80 dBA for construction noise. Noise levels would not exceed 80 dBA at any other times during construction.

Vibration

The maximum predicted vibration levels at the closest vibration-sensitive receptor (104 Bradford Place) would be 67 velocity decibels during construction to extend the Reynolds Lead. While not a regulatory standard for vibration during construction, to provide context, this vibration level would not exceed FTA/FRA criteria for vibration from construction at residences. Vibration from construction would be not be substantial enough to have an adverse impact at the nearest residence.

Construction—Indirect Impacts

Construction of the terminal at the Off-Site Alternative location would have the same indirect impacts as the On-Site Alternative. As described for the On-Site Alternative, the terminal at the Off-Site Alternative location would not result in indirect noise or vibration impacts related to construction road or rail traffic.

Operations—Direct Impacts

Operation of the terminal at the Off-Site Alternative location would result in the following direct impacts. Operations-related activities are described in Chapter 3, *Alternatives*.

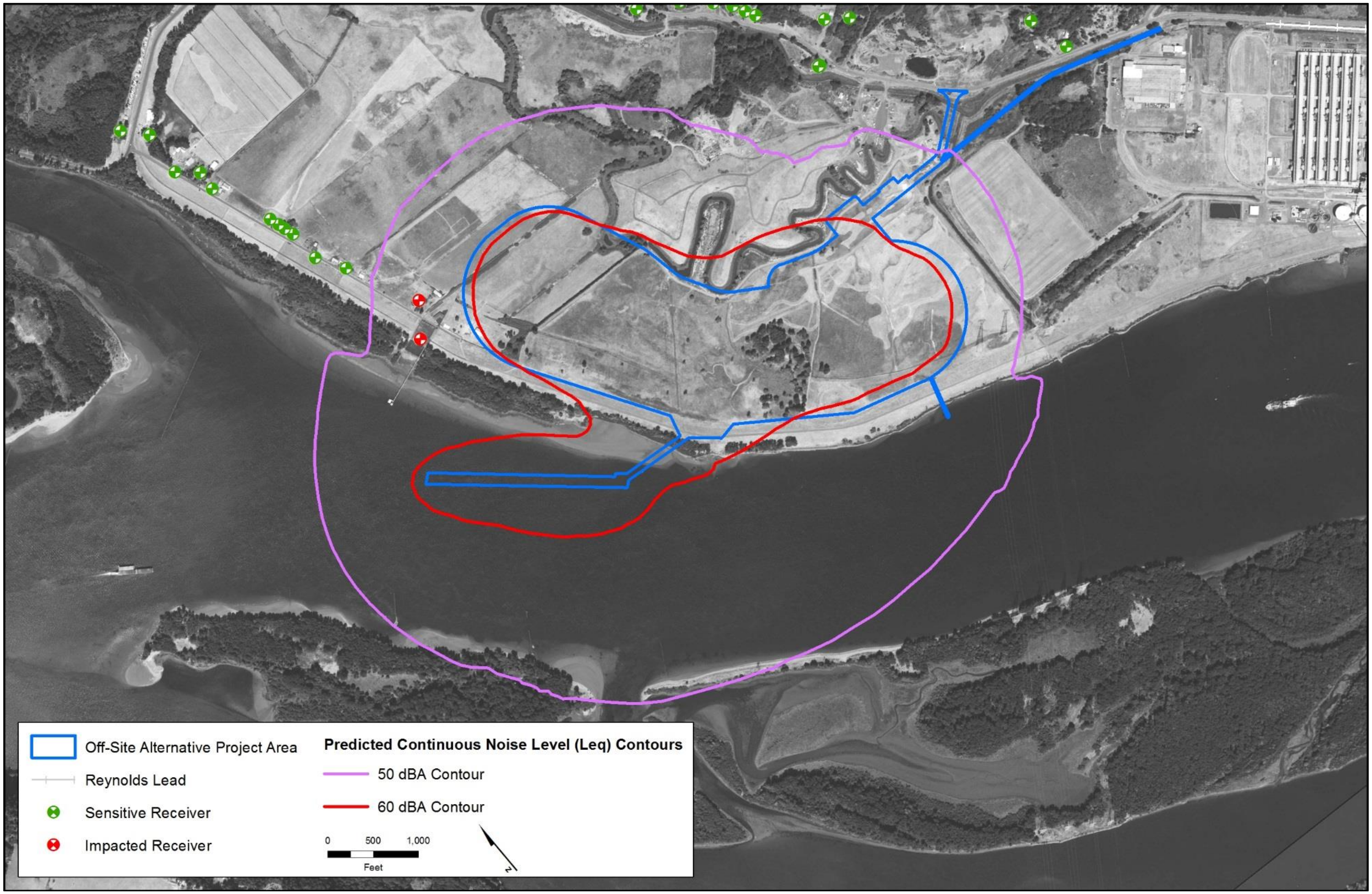
Noise

Figure 6.5-9 shows the predicted noise contours for operation of the terminal at the Off-Site Alternative location. Noise from export terminal operations is projected to exceed the Washington State noise standard at two residences (263 Barlow Point Road and 274 Barlow Point Road). These residences are within the 50-dBA contour, which is the applicable Washington State limit for nighttime noise levels in a residential area when the noise is from an industrial source. The predicted noise level at the residence is 53 dBA. Other residences are located outside the noise level limit contours or would be shielded by topography.

Vibration

As described in Section 6.5.3, *Methods*, no vibration impacts associated with operation of the terminal at the Off-Site Alternative location are anticipated. No substantial sources of ground vibration would occur at the project area during operations, and the closest vibration-sensitive receptor (a residence) is too far away to be affected by vibration from trains on the rail loop in the project area.

Figure 6.5-9. Predicted Continuous Noise Level (L_{eq}) Contours during Operations of the Off-Site Alternative



Operations—Indirect Impacts

Operation of the terminal at the Off-Site Alternative location would result in the following indirect impacts. Operations-related activities are described in Chapter 3, *Alternatives*.

Vehicle Traffic Noise

This impact would be the same as described for the On-Site Alternative.

Rail Traffic Noise

This impact would be the same as described for the On-Site Alternative.

Vessel Operations Noise

The terminal would load 70 vessels per month or 840 vessels per year. For vessels moored at the project area docks (Docks A and B), the noise associated with stationary vessels is estimated to be 37 dBA at the closest noise-sensitive receptors on Barlow Point Road, approximately 1,600 feet from the docks in the project area. This estimated project-related vessel noise would be comparable to or less than ambient noise levels at the closest noise-sensitive receptors.

The noise from project-related vessels underway and foghorns would be the same as described for the On-Site Alternative.

6.5.5.3 No-Action Alternative

Under the No-Action Alternative, the Corps would not issue a Department of the Army permit authorizing construction and operation of the proposed export terminal. As a result, impacts resulting from constructing and operating the terminal would not occur. In addition, not constructing the terminal would likely lead to expansion of the adjacent bulk product business onto the export terminal project area. The following discussion assesses the likely consequences of the No-Action Alternative related to noise and vibration.

A limited-scale future expansion scenario proposed by the Applicant was evaluated, as described in Chapter 3, *Alternatives*. Under this scenario, approximately 2 trains per day would use the Reynolds Lead and BNSF Spur. The potential for changes in noise levels of 2 train trips per day on the Reynolds Lead and BNSF Spur were analyzed for 2028. Plots of the equal L_{dn} noise levels from rail traffic related to the No-Action Alternative in 2028 are available in the *NEPA Noise and Vibration Technical Report*. This assessment showed the net increases relative to the existing noise exposure from 2 additional train trips per day on the Reynolds Lead and BNSF Spur did not reach the thresholds of moderate or severe impact. Vehicle traffic volumes under the scenario evaluated for the No-Action Alternative would be less than the proposed export terminal and would not result in an adverse noise impact. The analysis also concluded there would be no vibration impacts because the closest receptors are too far away to experience meaningful vibration generated by trains on the Reynolds Lead and BNSF Spur.

6.5.6 Required Permits

No permits related to noise and vibration would be required for construction and operation of the proposed export terminal.

6.6 Air Quality

Air quality is essential to human and environmental health, and is protected by federal, state, and local regulations. Air pollution can harm humans, plants, animals, and structures. Ambient air quality can be affected by climate, topography, meteorological conditions, and pollutants emitted from natural or human sources.

This section describes air quality in the study area and the potential impacts on air quality from construction and operation of the proposed export terminal. Coal dust, which can also affect air quality, is addressed separately in Section 6.7, *Coal Dust*.

6.6.1 Regulatory Setting

Laws and regulations related to air quality are summarized in Table 6.6-1.

Table 6.6-1. Regulations, Statutes, and Guidelines for Air Quality

Regulation, Statute, Guideline	Description
Federal	
Clean Air Act and Amendments	Enacted in 1970, as amended in 1977 and 1990, requires EPA to develop and enforce regulations to protect the public from air pollutants and their health impacts.
National Ambient Air Quality Standards (U.S. Environmental Protection Agency)	Specifies the maximum acceptable ambient concentrations for seven criteria air pollutants: CO, O_3, NO_2, SO_2, lead, PM2.5, and PM10. Primary NAAQS set limits to protect public health, and secondary NAAQS set limits to protect public welfare. Geographic areas where concentrations of a given criteria pollutant exceed a NAAQS are classified as nonattainment areas for that pollutant.
State	
Washington State General Regulations For Air Pollution Sources (WAC 173-400) and Washington State Clean Air Act (RCW 70.94)	Establish the rules and procedures to control or prevent the emissions of air pollutants. Provides the regulatory authority to control emissions from stationary sources, reporting requirements, emissions standards, permitting programs, and the control of air toxic emissions.
Washington State Operating Permit Regulation (WAC 173-401)	Establishes the elements for the state air operating permit program.
Washington State Controls for New Sources of Toxic Air Pollutants (WAC 173-460)	Establishes the systematic control of new or modified sources emitting toxic air pollution to prevent air pollution, reduce emissions, and maintain air quality that will protect human health and safety.
Washington State Ambient Air Quality Standards (WAC 173-476)	Establishes maximum acceptable levels in the ambient air for particulate matter, lead, SO_2, NO_2, O_3, and CO.

Regulation, Statute, Guideline	Description
Local	
Southwest Clean Air Agency (SWCAA 400)	Regulates stationary sources of air pollution in Clark, Cowlitz, Lewis, Skamania, and Wahkiakum Counties.

Notes:
EPA = U.S. Environmental Protection Agency; CO = carbon monoxide; O_3 = ozone; NO_2 = nitrogen oxides; SO_2 = sulfur dioxide; PM2.5 = particulate matter less than or equal to 2.5 micrometers in size; PM10 = particulate matter less than or equal to 10 micrometers in size; NAAQS = National Ambient Air Quality Standards; WAC = Washington Administrative Code; RCW = Revised Code of Washington; SWCAA = Southwest Clean Air Agency

6.6.1.1 Federal and State Ambient Air Quality Standards

Federal and state regulations govern maximum concentrations for criteria air pollutants, which are key indicators of air quality. Table 6.6-2 lists the federal ambient air quality standards for five criteria air pollutants plus total suspended particulates. Annual standards are never to be exceeded, while short-term standards are not to be exceeded more than once per year, except as noted in Table 6.6-2.

The National Ambient Air Quality Standards (NAAQS) consist of primary standards and secondary standards. Primary standards are designed to protect public health, including sensitive populations such as asthmatics, children, and the elderly. Secondary standards are designed to protect public welfare from effects such as visibility reduction, soiling, and nuisance (e.g., preventing air pollution damage to vegetation).

The NAAQS were established by the U.S. Environmental Protection Agency (EPA) under authority of the Clean Air Act to protect the public from air pollution. Air pollutants for which there are NAAQS are called *criteria pollutants*. Under the federal Clean Air Act, states are authorized to administer monitoring programs in different areas to determine if those areas are meeting the NAAQS.

EPA regulates nonroad mobile sources under the Clean Air Act to control emissions from nonroad engines (such as construction equipment, locomotives, and vessels). Regulations relevant to the proposed export terminal include locomotive emissions standards and limiting the sulfur content in fuel oil for marine vessels.

6.6.1.2 Federal and State Air Toxics

Under the federal Clean Air Act, EPA controls air toxics, which are pollutants known or suspected to cause cancer or other serious health effects, such as birth defects or reproductive effects. Examples of air toxics include benzene, formaldehyde, and toluene. EPA has identified 188 air toxics, which it refers to as hazardous air pollutants (HAPS). No ambient air quality standards have been established for HAPS, and, instead, EPA has identified all major industrial stationary sources that emit these pollutants and developed national technology-based performance standards to reduce their emissions. The performance standards are designed to ensure that major sources of HAPS are controlled, regardless of geographic location.

Table 6.6-2. Federal Ambient Air Quality Standards

	Primary	Secondary
Carbon monoxide		
8-hour average[a]	9 ppm	No standard
1-hour average[a]	35 ppm	No standard
Ozone		
8-hour average[b,c]	0.070 ppm	0.070 ppm
Nitrogen dioxide		
1-hour average[d]	100 ppb	No standard
Annual average	53 ppb	53 ppb
Sulfur dioxide		
Annual average	No standard	No standard
24-hour average[e]	No standard	No standard
3-hour average[e]	No standard	0.50 ppm
1-hour average[f]	75 ppb	No standard
Lead		
Rolling 3-month average	0.15 μg/m³	0.15 μg/m³
PM10		
24-hour average[g]	150 μg/m³	150 μg/m³
PM2.5		
Annual average[h]	12 μg/m³	15 μg/m³
24-hour average[i]	35 μg/m³	35 μg/m³

Notes:

[a] Not to be exceeded on more than 1 day per calendar year.

[b] In December 2015, EPA lowered the federal standard for 8-hour ozone from 0.075 ppm to 0.070 ppm.

[c] To attain this standard, the 3-year average of the fourth-highest daily maximum 8-hour average ozone concentrations measured at each monitor within an area over each year must not exceed 0.070 ppm.

[d] 98th percentile of 1-hour daily maximum concentrations, averaged over 3 years.

[e] Not to be exceeded more than once per calendar year.

[f] 99th percentile of 1-hour daily maximum concentrations averaged over 3 years.

[g] Not to be exceeded more than once per year average over 3 years.

[h] Annual mean averaged over 3 years.

[i] 98th percentile averaged over 3 years.

Source: U.S. Environmental Protection Agency 2012.

ppm = parts per million; ppb= parts per billion; PM10 = particulate matter with a diameter less than or equal to 10 micrometers; PM2.5 = particulate matter with a diameter less than or equal to 2.5 micrometers ; μg/m³ = micrograms per cubic meter

An action that requires a Notice of Construction application under WAC 173-400-110 is subject to the review requirements of controls for new source of toxic air pollutants, unless the emissions before control equipment of each toxic air pollutant from a new source or the increase in emissions from each modification is less than the applicable *de minimis* emissions threshold for the toxic air pollutant listed in WAC 173-460-150. Southwest Clean Air Agency has a separate list of pollutants that may apply to emissions from this stationary source. The purpose is to establish the systematic control of new or modified sources emitting toxic air pollutants to prevent air pollution to the extent reasonably possible and maintain levels of air quality to protect human health.

6.6.2 Study Area

The study areas are the same for both the On-Site Alternative and Off-Site Alternative. Direct impacts were analyzed within an approximate 5-mile radius around the project areas. Indirect impacts were analyzed up to approximately 20-mile radius from the project areas. These study areas are based on the Corps' NEPA scope of analysis Memorandum for Record (February 14, 2014), adjusted to reflect the sources of emissions in and near the project areas.

6.6.3 Methods

The following sources of information were used to identify the potential impacts of the proposed export terminal on air quality in the study areas.

- Data and information on terminal construction and operation (URS Corporation 2015)
- Northwest International Air Quality Environmental Science and Technology Consortium for existing conditions data (2015)
- *California Air Resources Board Vessel Transit Emissions Study* (California Air Resources Board 2011)
- National Climatic Data Center Longview, Washington climate data (National Climatic Data Center 2011)
- U.S. Environmental Protection Agency air pollutant emissions factors (U.S. Environmental Protection Agency 1995a, 1995b, 1995c, 1996)
- U.S. Environmental Protection Agency's air modeling guidance (U.S. Environmental Protection Agency 2004, 2014)
- U.S. Environmental Protection Agency's vessel fuel consumption data (U.S. Environmental Protection Agency 2000)
- U.S. Environmental Protection Agency's NONROAD Model (U.S. Environmental Protection Agency 2009)
- U.S. Environmental Protection Agency's vessel exhaust emissions standards (U.S. Environmental Protection Agency 2012)

6.6.3.1 Impact Analysis

The analysis evaluated emissions from construction and operations of the proposed export terminal. Air emissions were estimated for the criteria air pollutants carbon monoxide, nitrogen oxides, sulfur dioxide, particulate matter less than or equal to 2.5 micrometers in diameter (PM2.5), and particulate matter less than or equal to 10 micrometers in diameter (PM10). Total suspended particles and diesel particulate matter were also estimated. Because construction emissions are temporary and have a short period of activity, these emissions were only evaluated in comparison with emissions thresholds. Operations emissions, however, were evaluated with respect to their impacts on air quality.

Construction

The Applicant has identified three construction-material-delivery scenarios: delivery by truck, rail, or barge.

- **Truck.** If material is delivered by truck, it is assumed approximately 88,000 truck trips would be required over the construction period. Approximately 56,000 loaded trucks would be needed during the peak construction year.
- **Rail.** If material is delivered by rail, it is assumed approximately 35,000 loaded rail cars would be required over the construction period. Approximately two-thirds of the rail trips would occur during the peak construction year.
- **Barge.** If material is delivered by barge, it is assumed approximately 1,130 barge trips would be required over the construction period. Approximately two-thirds of the barge trips would occur during the peak construction year. Because the project area does not have an existing barge dock, the material would be off-loaded at an existing dock elsewhere on the Columbia River and transported to the project area by truck.

The emissions for all three scenarios were analyzed to determine the scenario with the highest emissions. Emissions were estimated for the peak construction year in each scenario.

The following sources of emissions were evaluated.

- Construction equipment operations
- Fugitive dust from earthwork activity
- Vehicle delays at at-grade rail crossings
- Construction worker vehicles commuting to the project area
- Truck emissions associated with delivery of construction supplies and materials
- Locomotive emissions associated with delivery of construction supplies and materials (rail delivery scenario only)
- River barges

Emissions were estimated based on frequency and duration of use and fuel types using EPA emissions data or the EPA NONROAD2008a model for nonroad construction equipment activity. The *NEPA Air Quality Technical Report* provides detailed information on the methods used to calculate emissions for the peak year of construction.

Operations

The air quality model assessed emissions from operation of the proposed export terminal and its impact on local air quality. The air quality modeling method followed general EPA protocols used in air quality permitting. Representative background concentrations for the study area (Northwest International Air Quality Environmental Science and Technology Consortium 2015)[1] were used to

[1] The Northwest International Air Quality Environmental Science and Technology Consortium (NW AIRQUEST) developed background design value estimates for 2009 through 2011 based on model-monitor interpolated products. These provide realistic background design value estimates where nearby ambient monitoring data are unavailable. The work is sponsored by EPA Regional 10, Ecology, and others.

determine background concentrations in air quality analyses since no representative monitoring data are available.

Emissions were estimated for operations that would emit particulate matter from the handling and transfer of coal, including unloading from rail cars, transferring coal on conveyors, piling coal onto storage piles, storing coal in storage piles, and loading coal onto ships. The on-site transfer and storage of coal would create fugitive emissions of coal dust due to product movement and wind erosion. In addition, the assessment considered locomotive exhaust emissions during the unloading and movement of project-related trains, emissions emitted from docked vessels during loading, emissions from tugs used to maneuver vessels into the terminal, emissions from operations and maintenance equipment, and vehicle delay at grade crossings along the Reynolds Lead and BNSF Spur. Emissions were evaluated using EPA's standard regulatory air dispersion model, AERMOD (Version 14134). AERMOD output results were compared to the federal and state ambient air quality standards presented in Table 6.6-2. To assess impacts associated with the proposed export terminal, the model was used to predict the increase in criteria air pollutant concentrations. The model's maximum incremental increases for each pollutant and averaging time were added to applicable background concentrations. The resulting total pollutant concentrations were then compared with the appropriate NAAQS.

Annual locomotive and vessel emissions for project-related trains and vessels were estimated and compared to existing annual emissions to provide context of potential air quality impacts beyond the project area. The *NEPA Air Quality Technical Report* provides detailed information on the methods used to calculate and model emissions during operations.

Coal Storage and Handling

Most on-site coal movement would occur in enclosed areas, including the rotary coal car dump and conveyors. Some transfer activities at the coal storage piles would not be enclosed; however, the conveyors, transfer towers, and the coal storage piles themselves would have systems in place for dust control (watering or dry fogging). Watering of the coal storage piles would help to reduce wind erosion. In general, the combination of these control systems would be expected to provide a high level of dust control (up to 99%). However, because these control systems would not operate with negative pressure,[2] a more conservative effectiveness assumption of 95% was used in this analysis.

Locomotives

The impact analysis approach for rail operations used EPA-projected emissions factors for line-haul locomotives, which are based on projected changes in locomotive fleet over the next 30 years (U.S. Environmental Protection Agency 2009). These emissions were based on locomotive engine load and associated fuel consumption during transport to and from the terminal, the unloading of coal from train cars, as well as the total annual coal throughput. It was assumed all locomotives would use ultra-low-sulfur diesel (15 parts per million [ppm] sulfur).

Vessels

The impact analysis approach for vessel operations assumed each marine vessel would need three tugs to maneuver the ship, and would require 3 hours total time to assist with docking and

[2] Negative pressure is a ventilation system that allows air to flow within an enclosed space, with more air pressure outside than inside.

departing operations. Further, it was estimated an average of 13 hours would be needed to load each vessel, and during this period of time, the vessel would be using auxiliary engines. To comply with International Maritime Organization 2016 Emission Control Areas for North America, all vessels were assumed to use the maximum allowed sulfur content marine distillate fuel of 0.1% (1,000 ppm). It was also assumed all tugboats would use ultra-low-sulfur diesel (15 ppm sulfur).

6.6.4 Affected Environment

This section describes the environment in the study areas related to air quality potentially affected by construction and operation of the proposed export terminal.

6.6.4.1 Attainment Status

EPA and Ecology designate regions as being attainment or nonattainment areas for regulated air pollutants. Attainment status indicates air quality in an area meets the federal, health-based ambient air quality standards. Nonattainment status indicates air quality in an area does not meet those standards. Cowlitz County is currently in attainment for all NAAQS. This designation means EPA and Ecology expect the area to meet air quality standards.

6.6.4.2 Air Quality Conditions

Climate and Meteorological Conditions

The project areas are located along the Columbia River in southwestern Washington, approximately 50 miles east of the Pacific Ocean. The region is characterized as a mid-latitude, west coast marine-type climate. The Cascade Range to the east has a large influence on the climate in Cowlitz County. The Cascade Range forms a barrier from continental air masses originating over the Columbia River Basin. The Cascades also induce heavy amounts of rainfall; as moist air from the west rises, it is forced to rise up the mountain slopes, which produces heavier rainfall on the western slopes of the Cascades and moderate rainfall in the low-lying areas, such as Longview.

Summers in the region are mild and dry. Winters are cool, but typically wet and cloudy with a small range in daily temperature. The average annual precipitation in Longview is approximately 48 inches, with most precipitation falling from November through March (National Climate Data Center 2011). Average annual rain events, taken as days with more than 0.01 inch of rainfall, occur approximately 175 days per year, based on National Climatic Data Center summaries.

Temperatures are usually mild in the lower Columbia River basin. Days with maximum temperatures above 90 degrees Fahrenheit (°F) occur about seven times per year on average. Days with a minimum temperature below 32°F occur about 57 times per year on average, and temperatures below 0°F occur only very rarely (none recorded between 1931 and 2006). Mean high temperatures range from the high 70s in the summer to mid-40s (°F) in winter, while average lows are generally in the low 50s in summer and mid-30s in winter.

Meteorological data collected by the Weyerhaeuser meteorological tower at the nearby Mint Farm Industrial Park between 2001 and 2003 (URS Corporation 2015) indicates the prevailing winds near the project areas are from the west-northwest and southeast, following along the alignment of the Columbia River. In the fall and winter (October through March), the winds are primarily from the southeast and east; the winds are typically from the west-northwest in the spring and summer (April through September).

Cowlitz County

Cowlitz County is in attainment or unclassified for all criteria air pollutants, indicating air quality near the project areas meet federal and state ambient air quality standards.

The only available local air pollutant monitoring is for PM2.5, at a station approximately 1.5 miles east of the project areas. The monitoring data show PM2.5 levels are well within the PM2.5 air quality standards. Although no other monitoring data are available, concentrations of other criteria air pollutants in the study area also are expected to be well within air quality standards.

The Longview air toxics study showed measured levels of toxic air pollutants were below levels of concern for short-term and long-term exposures (Southwest Clean Air Agency 2007). The study found, of the air toxics directly monitored, the air toxics of most concern for potential health risk in Longview are acetaldehyde, arsenic, benzene, manganese, and formaldehyde, while diesel particulate matter was identified as the most likely contributor to cancer risk in Washington State. No further studies on air toxic monitoring in the Longview-Kelso area have been conducted. The most recent national air toxic assessment showed Cowlitz County had an overall inhalation cancer risk of 30 cancers per million, which is lower than the state average of 40 cancers per million, as well as below the national average of 40 cancers per million (U.S. Environmental Protection Agency 2011).

6.6.5 Impacts

Potential direct and indirect impacts on air quality from construction and operation of the proposed export terminal are presented below.

6.6.5.1 On-Site Alternative

This section describes the potential impacts from construction and operation of the proposed export terminal at the On-Site Alternative location. The analysis and discussion of direct and indirect analyses are combined.

Construction

The construction material delivery scenario with the highest emissions would be the barge scenario, which would deliver construction materials via barge and truck. Haul truck emissions are included for the truck trips needed to make deliveries of construction material to the project area. Maximum annual construction emissions estimates for the peak construction year are shown in Table 6.6-3. Table 6.6-4 illustrates the maximum daily construction emissions estimates.[3]

[3] The estimated emissions shown assume that best management practices would be followed, including measures to reduce idling and dust generated by soil disturbance, and the application of water along access roads to minimize track-out of soil. Maximum daily emissions are relevant to short-term air quality standards that may be of concern for a long-term construction project. Construction emissions were based on a 5 days-per-week construction schedule with maximum activity levels for construction and earth movement equipment.

Table 6.6-3. Estimated Maximum Annual Construction Emissions

Source	Construction Emissions (tons per year) [maximum per year]								
	CO	NO_X	SO_2	PM2.5	PM10	VOCs	TSP	HAPS	DPM
Combustion Sources									
Equipment (in project area)	9.04	24.60	0.95	1.93	1.93	2.23	2.34	0.05	2.34
Haul trucks (in project area)	0.88	4.06	0.01	0.13	0.19	0.18	0.23	0.004	0.23
Haul trucks (in study area)[a]	2.04	9.37	0.03	0.31	0.44	0.41	0.54	0.010	0.54
Barges (not in study area)[b]	15.68	59.0	0.028	1.06	1.06	1.51	1.29	0.03	1.29
Passenger commute vehicles/crossing-delay (in study area)[a]	7.5	0.05	0.010	0.04	0.22	0.13	0.22	0.001	<0.001
Total Combustion Sources (in project area)	**9.92**	**28.66**	**0.96**	**2.06**	**2.12**	**2.41**	**2.57**	**0.05**	**2.57**
Total Combustion Sources (all study area)[c]	**19.5**	**38.1**	**1.0**	**2.4**	**2.8**	**2.95**	**3.3**	**0.07**	**3.1**
Fugitive Sources									
Fugitive earthwork (project area)	—	—	—	1.22	5.87	—	12.00	—	—
Total Fugitive Sources	**—**	**—**	**—**	**1.22**	**5.87**	**—**	**12.00**	**—**	**—**
Total									
Construction emissions sources (project area)	**9.9**	**28.7**	**0.96**	**3.28**	**7.99**	**2.41**	**14.6**	**0.05**	**2.6**
All construction emissions sources[c]	**19.5**	**38.1**	**1.0**	**3.6**	**8.7**	**2.95**	**15.3**	**0.07**	**3.1**
General Conformity *de minimis* levels for ozone maintenance areas (CFR 93.153)	100	100	100	100	100	100	—	—	—

Notes:

[a] Not in the project area but in study area.

[b] Not in the study area as defined Section 6.6.2, *Study Area,* provided for reference. Based on barge maneuvering time for docking of 0.5 hour in and 0.5 hour out; does not include transit on the Columbia River.

[c] Rounded. Does not include barge emissions (outside the study area).

CO = carbon monoxide; NO_X = nitrogen oxide; SO_2 = sulfur dioxide; PM2.5 = particulate matter less than or equal to 2.5 micrometers in diameter; PM10 = particulate matter less than or equal to 10 micrometers in diameter; VOCs = volatile organic compounds; TSP = total suspended particles; HAPS = hazardous air pollutants; DPM = diesel particulate matter; Fugitive Sources = emissions that are not directly vented through a stack, chimney, vent, or other functionally equivalent opening.

Table 6.6-4. Estimated Maximum Daily Construction Emissions

	Construction Emissions (pounds per day) [maximum daily]								
Source	**CO**	**NO_x**	**SO_2**	**PM2.5**	**PM10**	**VOCs**	**TSP**	**HAPS**	**DPM**
Combustion Sources									
Equipment (in project area)	82.89	229.60	8.67	17.66	17.66	20.40	21.49	0.42	21.50
Haul trucks (in project area)	14.40	54.70	0.20	2.60	5.00	3.10	6.10	0.10	6.12
Haul trucks (in study area)[a]	24.00	110.48	0.33	3.66	5.21	4.81	6.34	0.12	6.34
Barges (not in study area)[b]	120.80	454.70	0.21	8.14	8.14	11.6	9.90	0.61	9.90
Passenger commute and crossing delay (in study area)[a]	20.00	1.43	0.03	0.11	0.58	0.35	0.58	0.01	<0.001
Total Combustion Sources (in project area)	**97.29**	**284.3**	**8.87**	**20.26**	**22.66**	**23.50**	**27.59**	**0.52**	**27.62**
Total Combustion Sources (all study area)[c]	**141.29**	**396.2**	**9.23**	**24.0**	**28.5**	**28.7**	**34.5**	**0.65**	**34.0**
Fugitive Sources									
Fugitive earthwork (in project area)	—	—	—	6.80	32.6	—	66.7	—	—
Total Fugitive Sources	—	—	—	**6.80**	**32.6**	—	**66.7**	—	—
Total									
Construction emissions sources (project area)	**97.29**	**284.3**	**8.87**	**27.1**	**55.3**	**23.5**	**94.3**	**0.52**	**27.6**
All construction emissions sources[c]	**141.29**	**396.2**	**9.23**	**30.8**	**61.1**	**28.7**	**101.21**	**0.65**	**34.0**

Notes:

[a] Not in the project area but in study area.

[b] Not in the study area as defined Section 6.6.2, *Study Area*; provided for reference. Based on barge maneuvering time for docking of 0.5 hour in and 0.5 hour out; does not include transit on the Columbia River.

[c] Rounded. Does not include barge emissions (outside the study area).

CO = carbon monoxide; NO_X= nitrogen oxide; SO_2 = sulfur dioxide; PM2.5 = particulate matter less than or equal to 2.5 micrometers in diameter; PM10 = particulate matter less than or equal to 10 micrometers in diameter; VOCs = volatile organic compounds; TSP = total suspended particles; HAPS = hazardous air pollutants; DPM = diesel particulate matter; Fugitive Sources = emissions that are not directly vented through a stack, chimney, vent, or other functionally equivalent opening.

The maximum annual construction-related emissions would be well below the *de minimis* levels[4] established by EPA, as shown in Table 6.6-3. This means although emissions of criteria air pollutants would occur during construction, emissions would not be expected to cause a substantial change in air quality or adversely affect sensitive receptors[5] near the project area.[6]

Operations

Sources of emissions during operations would include coal handling equipment, coal storage piles, maintenance and operation vehicles, employee commute vehicles, and project-related trains and vessels.[7]

Emissions

As shown in Table 6.6-5, rail and vessel transport would be the largest sources of emissions during operations. The terminal would produce small quantities of air pollutants from maintenance and operational activities.

Impact Assessment

An analysis was performed with the AERMOD dispersion model and the results from the modeling compared with the NAAQS. Two sets of emissions were developed for use in the impact assessment. The first set was used to model annual average concentrations, reflecting emissions over an entire year with train and vessel arrivals spread across the year to simulate the average anticipated activity at the terminal. The second set of emissions was used to determine concentrations for the applicable short-term averaging period (1-hour, 3-hour, 8-hour, or 24-hour). Peak activity included a coal train unloading at the terminal, a vessel loading with coal, and a second vessel docking at the terminal.

Estimated emissions for the proposed export terminal, in combination with the background concentrations, are not anticipated to violate any NAAQS. Table 6.6-6 summarizes the maximum predicted criteria air pollutant concentrations due to maintenance and operation of the terminal, coal handling, and exhaust emissions from motor vehicles. The highest increase in concentration due to operation of the terminal is the 24-hour PM10 impact, which would increase 57 $\mu g/m^3$, or about 38% of the PM10 NAAQS. The next highest increase in concentration due to operation of the terminal is the 24-hour PM2.5 impact, which would increase 4.8 $\mu g/m^3$, or about 14% of the PM2.5 NAAQS. Similarly, the 1-hour NO_2 impact would increase 15 $\mu g/m^3$, or about 8% of the NO_2 NAAQS. All other pollutants would increase less than 2% of the relevant NAAQS.

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[4] The *de minimis* levels are the lowest thresholds that meet the General Conformity Rule for a federal action. This rule ensures that the action will conform to air quality standards.

[5] Sensitive air quality receptors were defined as a facility or land use that houses or attracts members of a population who are particularly sensitive to the effects of air pollutants, such as children, the elderly, and people with illnesses. Examples of sensitive receptors include schools, hospitals, day care centers, convalescent facilities, senior centers, and parks or recreational facilities.

[6] While the study area is in attainment for all criteria air pollutants and therefore not subject to federal General Conformity rules (40 CFR 93, subpart B), the emission *de minimis* levels were used to provide a threshold against which to evaluate potential impact from construction.

[7] This analysis was updated after publication of the SEPA Draft EIS based on a review of the analysis. This subsection reflects the revised results.

Table 6.6-5. Maximum Annual Average Emissions from Operations

Source	Maximum Annual Average Emissions (tons per year)								
	CO	NO_x	SO_2	PM2.5	PM10	TSP	VOCs	HAPS	DPM
Fugitive Sources									
Coal transfer (except coal storage piles)									
Material handling	—	—	—	0.28	1.84	5.25	—	—	—
Coal storage piles									
Wind erosion	—	—	—	0.14	0.92	1.08	—	—	—
Material handling	—	—	—	0.14	0.92	2.62	—	—	—
Mobile Sources									
Maintenance/operations equipment									
Combustion	1.42	4.36	0.19	0.31	0.31	0.38	0.36	0.01	0.38
Employee commute and crossing delay	2.05	0.13	0.003	0.02	0.08	0.008	0.04	0.01	<0.01
Locomotive									
Combustion (study area)[a]	7.63	17.5	0.027	0.36	0.37	0.45	0.60	0.08	0.45
Fugitive dust (study area)[a]	—	—	—	0.12	0.80	0.94	—	—	—
Combustion (project area)	4.00	11.6	0.01	0.24	0.25	0.30	0.48	0.04	0.21
Fugitive dust (project area)	—	—	—	0.27	1.79	2.10	—	—	—
Vessels									
Combustion (study area)[a]	37.9	24.8	3.04	1.64	1.78	2.17	14.1	0.03	0.00
Combustion (project area)	65.9	23.3	4.52	1.02	1.05	1.27	15.3	0.08	0.56
Total: All Mobile Sources, Project Area, Study Area	118.9	81.7	7.8	4.0	6.4	7.6	30.9	0.3	1.6
Total Project Area Sources	71.3	39.3	4.72	2.40	7.08	13.00	16.14	0.13	1.15
Fugitive Dust Only, Project Area	—	—	—	0.83	5.47	11.05	—	—	—
Mobile Combustion Sources, Project Area	71.32	39.26	4.72	1.57	1.61	1.95	16.4	0.13	1.15

Notes:

[a] Study area does not include the project area.

CO = carbon monoxide; NO_X = nitrogen oxide; SO_2 = sulfur dioxide; PM2.5 **=** particulate matter less than 2.5 micrometers in diameter**;** PM10 = particulate matter less than or equal to 10 micrometers in diameter**;** TSP = total suspended particles; VOCs = volatile organic compounds; HAPS = hazardous air pollutants; DPM = diesel particulate matter

Table 6.6-6. Maximum Modeled Concentrations from the Operation of the Proposed Export Terminal[a]

Pollutant	Averaging Period	Modeled Impact (μg/m³)	Background[b,c] (μg/m³)	Total Predicted Concentration (μg/m³)	NAAQS (μg/m³)
CO	1 hour[d]	10.7	827	838	40,000
	8 hour[d]	4	600	604	10,000
NO_2	1 hour[e,f]	15	56.6	72	188
	Annual[f,g]	0.4	5.3	6	100
SO_2	1 hour[h]	0.9	14.7	15.6	196
	3 hour[i]	0.6	11.5	12.1	1,300
PM2.5	24 hour[j]	4.8	17.8	22.6	35
	Annual[k]	0.2	6.1	6.3	12
PM10	24 hour[l]	57	23	80	150

Notes:

[a] Sources include emissions from handling coal, the coal storage piles, and mobile source exhaust emissions from operation and maintenance of the terminal.

[b] Background design value estimates for 2009 through 2011, based on model-monitor interpolated products (except PM2.5) sponsored by EPA Regional 10, Ecology, and others. From NW AIRQUEST tool Washington State University (http://www.lar.wsu.edu/nw-airquest/lookup.html.)

[c] PM2.5 background based on Ecology's Kelso Monitor (2012 through 2014).

[d] Modeled impact is the highest second high for each calendar year over the 3 modeled years.

[e] The NO_2 1-hour modeled impact is the 3-year average of the 98th percentile of 1-hour daily maximum concentrations.

[f] Modeled NO_2 impacts applied the Tier III Ozone Limiting Method (OLM), using an ozone background of 42ppb, as per the NW-AIRQUEST tool. For additional information regarding the modeling methodology, see the *NEPA Air Quality Technical Report*.

[g] The NO_2 annual modeled impact is the maximum annual mean over the 3 modeled years.

[h] The SO_2 1-hour modeled impact is the 3-year average of the 99th percentile of the 1-hour daily maximum concentrations.

[i] The SO_2 3-hour modeled impact is not to be exceeded more than once per year.

[j] The PM2.5 24-hour modeled impact is the 3-year average of the 98th percentile of 1-hour daily maximum concentrations.

[k] The PM2.5 annual modeled impact is the 3-year average of the annual mean.

[l] The PM10 24-hour modeled impact is 3-year average of the highest 2nd high concentration.

μg/m³ = micrograms per cubic meter; NAAQS = National Ambient Air Quality Standards; CO = carbon monoxide; NO_2 = nitrogen dioxide; SO_2 = sulfur dioxide; PM2.5 = particulate matter less than or equal to 2.5 micrometers in diameter; PM10 = particulate matter less than or equal to 10 micrometers in diameter

Table 6.6-7 shows the modeling results for sources in the project area plus cargo vessel and train operations while in the project area.

The highest increase in emissions from operation of the terminal plus cargo vessel and train operations is the 1-hour NO_2 impact, which would increase 93 μg/m³, or about 50% of the NO_2 NAAQS. The next highest increase concentration increase is the 24-hour PM10 impact, which would increase 66 μg/m³, or about 44% of the PM10 NAAQS. Similarly, the 24-hour PM2.5 impact would increase 7 μg/m³, or about 20% of the PM2.5 NAAQS. All other pollutants would increase less than 10% of the relevant NAAQS.

Table 6.6-7. Project Area Concentration from Operations (All Sources)[a]

Pollutant	Averaging Period	Modeled Impact (μg/m³)	Background[b,c] (μg/m³)	Total Predicted Concentration (μg/m³)	NAAQS (μg/m³)
CO	1 hour[d]	220	827	1,047	40,000
	8 hour[d]	43	600	643	10,000
NO_2	1 hour[d,e]	93	56.6	149.6	188
	Annual[f,g]	9.0	5.3	14.3	100
SO_2	1 hour[h]	3	14.7	17.7	196
	3 hour[i]	2	11.5	13.5	1,300
PM2.5	24 hour[j]	7	17.8	24.8	35
	Annual[k]	0.6	6.1	6.7	12
PM10	24 hour[l]	66	23	89	150

Notes:

[a] Sources include emissions from handling coal, the coal storage piles, and mobile source exhaust emissions from the operation and maintenance of the facility.

[b] Background design value estimates for 2009 through 2011, based on model-monitor interpolated products (except PM2.5) sponsored by EPA Regional 10, Ecology, and others. From NW AIRQUEST tool Washington State University (http://www.lar.wsu.edu/nw-airquest/lookup.html.)

[c] PM2.5 background based on Ecology's Kelso Monitor (2012 through 2014).

[d] Modeled impact is the highest second high for each calendar year over the 3 modeled years.

[e] The NO_2 1-hour modeled impact is the 3-year average of the 98th percentile of 1-hour daily maximum concentrations.

[f] Modeled NO_2 impacts applied the Tier III Ozone Limiting Method (OLM), using an ozone background of 42ppb, as per the NW-AIRQUEST tool. For additional information regarding the modeling methodology, see the *NEPA Air Quality Technical Report*.

[g] The NO_2 annual modeled impact is the maximum annual mean over the 3 modeled years.

[h] The SO_2 1-hour modeled impact is the 3-year average of the 99th percentile of the 1-hour daily maximum concentrations.

[i] The SO_2 3-hour modeled impact is not to be exceeded more than once per year.

[j] The PM2.5 24-hour modeled impact is the 3-year average of the 98th percentile of 1-hour daily maximum concentrations.

[k] The PM2.5 annual modeled impact is the 3-year average of the annual mean.

[l] The PM10 24-hour modeled impact is 3-year average of the highest 2nd high concentration.

μg/m³ = micrograms per cubic meter; NAAQS = National Ambient Air Quality Standards; CO = carbon monoxide; NO_2 = nitrogen dioxide; SO_2 = sulfur dioxide; PM2.5 **=** particulate matter less than or equal to 2.5 micrometers in diameter**;** PM10 = particulate matter less than or equal to 10 micrometers in diameter

Table 6.6-8 shows the modeling results for all project area sources and study area sources (vessels arriving and departing from the terminal, assist tugs, plus trains arriving and departing from the terminal, to approximately 5 miles out). These results are similar to the project area sources. The highest increase in emissions is the 1-hour NO_2 impact, which would increase 93 μg/m³, or about 50% of the NO_2 NAAQS. The next highest increase concentration increase is the 24-hour PM10 impact, which would increase 66 μg/m³, or about 44% of the PM10 NAAQS. Similarly, the 24-hour PM2.5 impact would increase 7 μg/m³, or about 20% of the PM2.5 NAAQS. All other pollutants would increase no more than 10% of the relevant NAAQS.

Table 6.6-8. Study Area Concentrations from Operations (All Sources)

Pollutant	Averaging Period	Modeled Impact ($\mu g/m^3$)	Background[a,b] ($\mu g/m^3$)	Total Predicted Concentration ($\mu g/m^3$)	NAAQS ($\mu g/m^3$)
CO	1 hour[c]	346	827	1,173	40,000
	8 hour[c]	97	600	697	10,000
NO_2	1 hour[c,d]	93	56.6	149.6	188
	Annual[e, f]	10	5.3	15.3	100
SO_2	1 hour[g]	10	14.7	24.7	196
	3 hour[h]	10	11.5	21.5	1,300
PM2.5	24 hour[i]	7	17.8	24.8	35
	Annual[j]	0.7	6.1	6.8	12
PM10	24 hour[k]	66	23	89	150

Notes:

[a] Background design value estimates for 2009 through 2011, based on model-monitor interpolated products (except PM2.5) sponsored by EPA Regional 10, Ecology, and others. Source: NW AIRQUEST tool Washington State University (http://www.lar.wsu.edu/nw-airquest/lookup.html.)

[b] PM2.5 background based on Ecology's Kelso Monitor (2012 through 2014).

[c] Modeled impact is the highest 2nd high for each calendar year over the 3 modeled years.

[d] The NO_2 1-hour modeled impact is the 3-year average of the 98th percentile of 1-hour daily maximum concentrations.

[e] Modeled NO_2 impacts applied the Tier III Ozone Limiting Method, using an ozone background of 42ppb, as per the NW-AIRQUEST tool.

[f] The NO_2 annual modeled impact is the maximum annual mean over the 3 modeled years.

[g] The SO_2 1-hour modeled impact is the 3-year average of the 99th percentile of the 1-hour daily maximum concentrations.

[h] The SO_2 3-hour modeled impact is not to be exceeded more than once per year.

[i] The PM2.5 24-hour modeled impact is the 3-year average of the 98th percentile of 1-hour daily maximum concentrations.

[j] The PM2.5 annual modeled impact is the 3-year average of the annual mean.

[k] The PM10 24-hour modeled impact is 3-year average of the highest second high concentration.

$\mu g/m^3$ = micrograms per cubic meter; NAAQS = National Ambient Air Quality Standards; CO = carbon monoxide; SO_2 = sulfur dioxide; NO_2 = nitrogen dioxide; PM2.5 **=** particulate matter less than or equal to 2.5 micrometers in diameter**;** PM10 = particulate matter less than or equal to 10 micrometers in diameter**;**

6.6.5.2 Off-Site Alternative

This section describes the potential impacts of construction and operation of the proposed export terminal at the Off-Site Alternative location. As noted in Section 6.6.2, *Study Area*, air emissions are aggregated and regulated at a larger scale than a localized study area. Therefore, the direct and indirect impacts of the On-Site Alternative are combined.

Construction

Construction of the terminal at the Off-Site Alternative location would have the same construction activity levels and emissions sources as the On-Site Alternative. Therefore, estimated maximum daily and annual construction emissions would be very similar to the On-Site Alternative, which were estimated to be well below the *de minimis* levels established by EPA. This means that although emissions of criteria pollutants would occur, they would not be expected to cause a substantial change in air quality and are unlikely to adversely affect sensitive receptors near the project area.

Operations

Operation of the terminal at the Off-Site Alternative location would have similar direct and indirect impacts on air quality as the On-Site Alternative. Operation activity levels and emissions sources in the project area would be the same as the On-Site Alternative. Emissions from project-related trains outside the project area but within the study area would increase approximately 7% because project-related trains would travel approximately 0.5 mile further on the Reynolds Lead to the Off-Site Alternative project area than project-related trains under the On-Site Alternative. Vessel transport was estimated to be the largest source of emissions during operations for the On-Site Alternative (Table 6.6-5). Vessel transport in the study area would be approximately 13% lower than vessel emissions for the On-Site Alternative because vessels would not need to travel as far upriver as the On-Site Alternative location. Using the findings from the On-Site Alternative analysis and this subsection, the maximum impacts for each pollutant plus maximum background concentrations under the Off-Site Alternative are anticipated to be below the NAQQS for all criteria pollutants.

6.6.5.3 No-Action Alternative

Under the No-Action Alternative, the Corps would not issue a Department of the Army permit authorizing construction and operation of the proposed export terminal. As a result, impacts resulting from constructing and operating the terminal would not occur. In addition, not constructing the terminal would likely lead to expansion of the adjacent bulk product business onto the On-Site Alternative project area.

A limited-scale future expansion scenario proposed by the Applicant was evaluated, as described in Chapter 3, *Alternatives*. Emissions were estimated for rail and vessel operations and emissions associated with truck transport to the nearby Weyerhaeuser facility under this scenario (Table 6.6-9). The largest emissions for any single air pollutant would be nitrogen oxides at 4.4 tons per year. These emissions would be substantially lower than the proposed export terminal, which were shown not to cause a substantial change in air quality or adversely affect nearby population areas.

Table 6.6-9. Estimated No-Action Alternative Annual Average Emissions from Rail, Vessel, and Haul Trucks

	Maximum Annual Average Emissions (tons per year)								
Source	**CO**	**NO_X**	**SO_2**	**PM2.5**	**PM10**	**VOCs**	**TSP**	**HAPS**	**DPM**
Locomotive combustion	1.4	3.1	0.01	0.06	0.07	0.11	0.08	0.01	0.06
Vessel combustion	2.6	1.1	0.19	0.06	0.06	0.63	0.08	0.003	0.02
Haul trucks	0.1	0.2	0.002	0.01	0.04	0.02	0.04	0.001	0.04
Total	**4.1**	**4.4**	**0.20**	**0.13**	**0.17**	**0.76**	**0.20**	**0.014**	**0.12**

Notes:
CO = carbon monoxide; NO_X= nitrogen oxide; SO_2 = sulfur dioxide; PM2.5 = particulate matter less than or equal to 2.5 micrometers in diameter; PM10 = particulate matter less than or equal to 10 micrometers in diameter; VOCs = volatile organic compounds; TSP = total suspended particles; HAPS = hazardous air pollutants; DPM = diesel particulate matter

6.6.6 Required Permits

The following permit would be required for the proposed export terminal.

- **Notice of Construction—Southwest Clean Air Agency.** Businesses and industries causing, or have the potential to cause, air pollution are required to receive approval from the local air agency prior to beginning construction. These are requirements of Washington's Clean Air Act and apply statewide (Chapter 70.94 Revised Code of Washington [RCW]). Businesses located in Cowlitz County are regulated by the Southwest Clean Air Agency. The agency rules generally require an air permit for stationary sources emitting more than 0.75 ton per year of PM10 or 0.5 ton per year for PM2.5.[8] It is anticipated these levels would be exceeded and the Applicant would need to file a permit application and receive an approved Notice of Construction air permit prior to constructing, installing, establishing, or modifying any equipment or operations that may emit air pollution.

[8] Other criteria air pollutants have higher emission thresholds.

6.7 Coal Dust

Coal dust is a form of particulate matter[1] and can affect air quality. Coal loaded onto trains consists of pieces and particles of differing size, including small particles or dust. Wind and air moving over trains can cause coal dust to blow off the rail cars, disperse, and settle onto the ground or other surfaces. Coal dust can also be created from the movement and transfer of coal at an industrial facility. The deposition of coal dust can be a nuisance and affect the aesthetics, look, or cleanliness of surfaces.

This section provides an introduction to coal dust, describes the affected environment relative to coal dust in the study area, and identifies potential impacts related to coal dust from construction and operation of the proposed export terminal.

6.7.1 Regulatory Setting

Laws and regulations relevant to coal dust are summarized in Table 6.7-1.

Table 6.7-1. Regulations, Statutes, and Guidelines Applicable to Coal Dust

Regulation, Statute, Guideline	Description
Federal	
Clean Air Act and Amendments	Enacted in 1970, as amended in 1977 and 1990, requires EPA to develop and enforce regulations to protect the public from air pollutants and their health impacts. This includes Clean Air Act Section 175A to continue maintaining the National Ambient Air Quality Standards in Washington State maintenance areas.
National Ambient Air Quality Standards	Specifies the maximum acceptable ambient concentrations for seven criteria air pollutants: CO, O_3, NO_2, SO_2, lead, PM2.5, and PM10. Coal dust would be part of the PM2.5 and PM10 air pollutants. Primary NAAQS set limits to protect public health, and secondary NAAQS set limits to protect public welfare. Geographic areas where concentrations of a given criteria pollutant exceed a NAAQS are classified as nonattainment areas for that pollutant.
State	
Washington State General Regulations For Air Pollution Sources (WAC 173-400) and Washington State Clean Air Act (RCW 70.94)	Establishes the rules and procedures to control or prevent the emissions of air pollutants. Provides the regulatory authority to control emissions from stationary sources, reporting requirements, emissions standards, permitting programs, and the control of air toxic emissions through best practices and best available control technologies.

[1] Particulate matter is a complex mixture of extremely small particles and liquid droplets. Particulate matter pollution can be composed of a number of components, including nitrates, sulfates, organic chemicals, metals, soil, and dust particles.

Regulation, Statute, Guideline	Description
Local	
Southwest Clean Air Agency (SWCAA 400)	Regulates stationary sources of air pollution in Clark, Cowlitz, Lewis, Skamania, and Wahkiakum Counties.

Notes:
EPA = U.S. Environmental Protection Agency; CO = carbon monoxide; O_3 = ozone; NO_2 = nitrogen oxides; SO_2 = sulfur dioxide; PM2.5 = particulate matter up to 2.5 micrometers in size; PM10 = particulate matter up to 10 micrometers in size; NAAQS = National Ambient Air Quality Standards; WAC = Washington Administrative Code; RCW = Revised Code of Washington; SWCAA = Southwest Clean Air Agency

In occupational settings (such as coal mines), exposure to airborne coal dust is regulated by agencies such as the Occupational Safety and Health Administration and the Mine Safety and Health Administration. In nonoccupational settings (such as outdoor exposures) exposure to coal dust in combination with all other types of particulate matter and dust in the air is regulated by the U.S. Environmental Protection Agency (EPA). The federal regulation applicable to particulate matter is part of the National Ambient Air Quality Standards (NAAQS). These standards apply to particle sizes with diameter of less than or equal to 10 micrometers (PM10) and particles with a mean diameter of less than or equal to 2.5 micrometers (PM2.5) (40 Code of Federal Regulations [CFR] 50). The NAAQS were established under the authority of the federal Clean Air Act to protect human health, including sensitive populations such as children and the elderly, with a margin of safety. The Clean Air Act identifies two types of NAAQS. Primary standards provide public health protection, including protecting the health of "sensitive" populations such as asthmatics, children, and the elderly. Secondary standards provide public welfare protection, including protection against decreased visibility and damage to animals, crops, vegetation, and buildings.

There are no federal or state guidelines or quantitative standards in the United States identifying acceptable levels of ambient dust deposition.[2] The *Good Practice Guide for Assessing and Managing the Environmental Effects of Dust Emissions* (New Zealand Ministry of Environment 2001) study cites acceptable levels of dust deposition and identifies two trigger levels for dust nuisance impacts[3] above current background levels.

- 4.0 grams per square meter per month (g/m^2/month) for industrial or sparsely populated locations. This equates to an approximate visible layer of dust on outdoor furniture or window sills.
- 2.0 g/m^2/month for sensitive residential locations.

A highly visible dust, such as black coal dust, will cause visible soiling at lower levels than other types of dust. British Columbia, Canada, has a less stringent maximum desirable level for average dustfall in a residential area of 5.1 g/m^2/month and for nonresidential areas of 8.7 g/m^2/month (British Columbia Ministry of Environment 2014).

[2] Washington Administrative Code (WAC) 173-400-040(3) (Fallout) relates to fallout, but does not provide a reference level: "No person shall cause or allow the emission of particulate matter from any source to be deposited beyond the property under direct control of the owner or operator of the source in sufficient quantity to interfere unreasonably with the use and enjoyment of the property upon which the material is deposited."

[3] Refers to the level of dust deposition that affects the aesthetics, look, or cleanliness of surfaces but not the health of humans and the environment.

6.7.1.1 Railroad Coal Dust Requirements

The BNSF Railway Company (BNSF) Coal Loading Rule[4] requires all shippers at any Montana or Wyoming coal mine to take measures to load cars in a way that ensures coal dust losses in transit are reduced by at least 85% compared to rail cars where no remedial measures have been taken. This is most commonly done by loading coal rail cars with a modified loading chute that produces a coal bed with a rounded top. This shaped profile limits the loss of coal dust from wind while the train is moving. In addition to the shaped profile, topper agents (i.e., surfactants) are applied to the surface of the coal mound to limit coal dust loss. The topper agent is applied before leaving the coal mine area. The Safe Harbor provision in the BNSF Coal Loading Rule identifies five acceptable topper agents and application rates that BNSF states have been shown to reduce coal dust losses by at least 85% when used in conjunction with coal load profiling. A shipper can use any of the five approved topping agents.[5]

In 2014, BNSF constructed and began operating a surfactant spray facility along its main line in Pasco, Washington, where coal trains traveling west along the main line route through the Columbia River Gorge are sprayed with a topper agent to lessen potential coal dust release from rail cars.

6.7.2 Study Area

The study area for direct impacts is the project area and the area beyond the project area potentially affected by export terminal operations. The study area for indirect impacts is the project area plus the areas within 1,000 feet of the Reynolds Lead and BNSF Spur.

6.7.3 Methods

This section describes the sources of information and methods used to evaluate the potential impacts of coal dust from construction and operation of the proposed export terminal.

6.7.3.1 Information Sources

The following sources of information were used to identify the potential impacts of coal dust related to the proposed export terminal.

- *Millennium Coal Export Terminal, Longview, Washington Environmental Report Air Quality* (URS Corporation 2015).
- *Millennium Bulk Terminals—Longview SEPA Draft Environmental Impact Statement* (Cowlitz County and Washington State Department of Ecology 2016).
- Information from the Applicant about anticipated coal-handling and transfer activities.

6.7.3.2 Impact Analysis

The following methods were used to evaluate the potential impacts of the proposed terminal related to coal dust. The methods for direct impacts during construction are not addressed because coal would not be handled in the project area or transported by rail during construction of the proposed

[4] For more information, see http://www.bnsf.com/customers/what-can-i-ship/coal/coal-dust.html.

[5] For more information, see http://www.bnsf.com/customers/what-can-i-ship/coal/include/dust-toppers.xls.

export terminal. For operations of the export terminal, air quality modeling was performed for the following primary sources of coal dust.

- Transfer and handling of the coal from rail to storage piles.
- Fugitive emissions from coal storage piles.
- Transfer and handling of coal from storage piles to ship.

For the transport of the coal via rail to the proposed export terminal, air quality modeling was conducted based on the coal dust emissions estimated from a moving train with some adjustments in the fugitive coal dust emissions rates from uncovered rail cars based on the 2014 air quality monitoring study conducted in Cowlitz County as summarized in this section.

Direct Impacts

Operation of the export terminal would result in coal dust emissions, including during the handling and transfer of coal related to rail unloading, shiploading, conveyor transfer, coal-pile development and removal, and wind erosion of coal piles. Coal transfers would occur in enclosed areas (e.g., rotary coal car dump facility, conveyors) and open areas (e.g., coal storage piles).

Coal dust emissions and impacts in the study area were assessed using the EPA atmospheric dispersion modeling system, Version 14134 (AERMOD). The model was used to estimate the coal dust deposition during operations. AERMOD was used because impacts would be localized, and the model is designed to assess emissions for multiple point, area, and volume sources in simple and complex terrain, and uses hourly local meteorological data. In addition, AERMOD estimates the deposition of particulates (such as coal dust) using information on the particulates' emissions rate and particle sizes.

The modeling estimated coal dust deposition impacts from coal dust emissions for full operations (44 million metric tons of coal per year). Table 6.7-2 summarizes the sources of coal dust emissions and their estimated annual average emissions rates used in the analysis to assess coal dust deposition impacts from export terminal operations outside the project area. Larger particles would be deposited in the project area.

Table 6.7-2. Coal Dust Total Suspended Particulates Emissions Rates at Maximum Throughput

Operation	Annual Average TSP Emissions Rate (tons per year)
Coal pile wind erosion	1.08
Coal pile development and removal	2.62
Ship transfer and conveyors	5.25
Train unloading	2.10
Total	**11.05**

Notes:
TSP = total suspended particulates

Coal dust emissions were characterized as two source types: volume and area. Coal transfer operations were characterized as volume sources, which included eight transfer towers, a rotary rail dump, surge bin work points, and two conveyors to load coal onto the ships with emissions rates estimated based on EPA AP-42, Section 13.2.4. Area sources are used to model low-level ground releases. The coal piles were modeled as area sources with the emissions estimated following the EPA AP-42, Section 13.2.5 approach. The coal dust emissions from tandem rotary unloaders that would unload the coal were modeled as a volume source with emissions estimated following the EPA AP-42, Section 13.2.5 approach. Weyerhaeuser's Mint Farm meteorological station was used in the analysis for the years 2001 to 2003. This station is located approximately 0.5 mile southeast of the project area for the On-Site Alternative.

The modeling was completed for the deposition of the coal particles and a more conservative assumption about the effectiveness of full enclosures and spray/fogging for conveyors. A 95% reduction effectiveness was assumed for the enclosed conveyor and spray/fogging systems, which is consistent with a similar facility's draft permit from the Oregon Department of Environmental Quality (2013).

The analysis used particle size distribution data from mines in Australia (Katestone 2009). Emissions rates in the project area were based on EPA AP-42 methods and meteorological data from Weyerhaeuser's Mint Farm meteorological station (approximately 0.5 mile from the project area).

Indirect Impacts

Over the past 10 years, air quality monitoring studies have collected information on the deposition and ambient concentration levels of coal dust associated with coal train operations. These studies have been conducted in various locations, including Australia, Canada, and the United States. However, the available documentation from these studies often does not provide information on all factors affecting coal dust emissions from trains.[6]

For the *SEPA Millennium Bulk Terminals-Longview Draft Environmental Impact Statement* (Cowlitz County and Washington State Department of Ecology 2016), to supplement existing studies, a field study was conducted in October 2014. The study collected sample data on coal dust emitted from existing coal trains on the BNSF main line just north of the Lewis River in Cowlitz County. In this area, freight trains generally travel at speeds of 40 to 45 miles per hour. The objective of the study was to collect coal dust data at a location in Cowlitz County under conditions conducive to coal dust emissions from passing coal trains. The findings of the field study (Cowlitz County and Washington State Department of Ecology 2016) and information from other coal dust studies were used to estimate coal dust emissions from project-related trains on the Reynolds Lead and BNSF Spur for this Draft EIS.

6.7.4 Affected Environment

This section provides an overview of coal dust characteristics and factors, as well as equipment that can contribute to particulate and deposition coal dust. This information provides the foundation for the impacts analysis.

6.7.4.1 Introduction to Coal Dust

Coal dust is a form of particulate matter. Particulate matter is composed of small particles suspended in the air. There are both natural and human sources of particulate matter. Natural sources include dust storms and smoke from wildfires. Human sources include but are not limited to

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[6] Factors include rail car size, number of rail cars, shaping of the coal in the rail car, application and type of topping agent, distance over which the coal is transported, and meteorological conditions.

smoke from industrial emissions, agricultural activities, construction activities, wood smoke, vehicle engine exhaust, unpaved road dust, tobacco smoke, and coal dust. Rail cars and coal-handling facilities generate and emit coal dust.

The total amount of fugitive coal dust released by a rail car depends on the following factors.

- Coal type and composition
- Coal moisture content
- Ambient wind speed and direction
- Precipitation falling on the coal
- Topper agents or dust suppressants
- Size of the top opening of the rail car
- Shape (profile) of the coal surface in the car
- Position of the car in the train
- Time and distance traveled
- Train speed

The amount of fugitive coal dust released by a coal-handling facility depends on the following factors.

- Transfer or handling process
- Enclosures or other physical barriers
- Additional controls, such as spraying/fogging
- Shape (profile) of coal pile

Coal dust and other forms of particulate matter do not remain in the air indefinitely. Eventually, these particles settle out of the air and deposit on the ground. Coal dust may be deposited directly onto the rail ballast, along the rail right-of-way, or in adjacent areas. Where the coal dust lands (the distance from and the direction from the rail right-of-way) depends on particle size, wind speed, and other meteorological conditions.

Airborne coal dust dispersion can be predicted using mathematical models describing the physical processes to simulate the particulate matter concentration. These models, known as dispersion models, take into account the time-varying sources of emission, as well as meteorological and seasonal conditions. The models require reasonable estimates of emissions rates to yield reliable estimates of the dispersion and deposition of particulate matter. This analysis used a dispersion model to assess coal dust deposition from construction and operation of the proposed export terminal.

6.7.4.2 Current Conditions in the Study Area

The existing bulk product terminal in the Applicant's leased area currently receives 1 to 2 coal trains per week, consisting of 25 to 30 coal rail cars. Coal is stored in silos in the Applicant's leased area, adjacent to the project area, and transferred via truck to the Weyerhaeuser facility, located 1 mile to the southeast. Coal dust emissions are estimated to be small and confined almost entirely to the

Applicant's leased area. Operations at the existing bulk product terminal are in compliance with an air permit issued by the Southwest Clean Air Agency.

Cowlitz County is classified as an attainment area or unclassified[7] for both PM10 and PM2.5. Of these two pollutants, only PM2.5 is currently being monitored. Refer to Section 6.6, *Air Quality*, for additional information.

6.7.5 Impacts

This section describes the potential direct and indirect impacts related to coal dust from construction and operation of the proposed export terminal.

6.7.5.1 On-Site Alternative

At full operation, project-related trains would add 8 loaded and 8 empty coal trains per day (16 total trains per day) to BNSF Spur and Reynolds Lead traffic. In the project area, unloading facilities would unload coal from rail cars within an enclosed structure. The unloading facilities would contain equipment to rotate rail cars and discharge the coal from the rail cars into a large hopper. As the tandem rotary dumper rotates the rail cars and begins to unload the coal, water would be sprayed on the coal to minimize dust dispersion.

A network of belt conveyors would transport coal from the rail car unloading facilities to the stockpile area, and from the stockpile area to the vessel-loading facilities, or from rail cars directly to the vessel-loading facilities. All belt conveyors and transfer stations would be fully enclosed, except for the stockpile area and vessel-loading conveyors, which would be open due to their operational requirements. The coal stockpile area would have a dust suppression system. Vessels would be loaded using shiploaders with an enclosed boom and loading spout. A telescoping loading spout would be inserted below the deck of the vessel during loading to minimize dust dispersion.

Construction

Construction of the proposed export terminal would not result in direct or indirect impacts related to coal dust because construction would not involve coal-handling or transport activities.

Operations—Direct Impacts

Operation of the proposed terminal would result in the following direct impact.[8]

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[7] The U.S. Environmental Protection Agency (EPA) and Washington State Department of Ecology (Ecology) designate regions as being attainment or nonattainment areas for regulated air pollutants. Attainment status indicates air quality in an area meets the federal, health-based ambient air quality standards. Unclassified is an area with not enough air quality monitoring data has been collected to classify the area.

[8] This analysis was updated after publication of the *Millennium Bulk Terminals—Longview SEPA Draft Environmental Impact Statement* (Cowlitz County and Washington State Department of Ecology 2016) based on a review of the analysis. This subsection reflects the revised results.

Coal Dust in and near the Project Area

Operation of the terminal would emit coal dust from coal-handling and transport activities in the project area.[9] Table 6.7-3 illustrates the estimated maximum annual and monthly coal dust deposition at or beyond the project area boundary.

Table 6.7-3. Estimated Maximum Annual and Monthly Coal Dust Deposition

Location	Maximum Annual Deposition ($g/m^2/year$)	Maximum Monthly Deposition ($g/m^2/month$)	Benchmark Used for Analysis ($g/m^2/month$)[a]
Project area boundary (fence line) near Mt. Solo Road	1.45	0.35	2.00

Notes:
[a] Source: New Zealand Ministry of Environment 2001
$g/m^2/year$ = grams per square meter per year; $g/m^2/month$ = grams per square meter per month

The estimated maximum monthly coal dust deposition (0.35 $g/m^2/month$) would be at the project area boundary near Mt. Solo Road (Figure 6.7-1). The estimated maximum monthly coal dust deposition (0.35 $g/m^2/month$) would be below the benchmark used for the analysis (2.0 $g/m^2/month$). The spatial extent of the estimated maximum annual coal dust deposition near the project area is shown in Figure 6.7-2. As shown, within a few thousand feet of the project area, the annual deposition of coal dust is estimated to be less than 0.1 g/m^2.

Operations—Indirect Impacts

Operation of the export terminal would result in the following indirect impacts.

Coal Dust along the Reynolds Lead and BNSF Spur

A dispersion model was performed to assess coal dust deposition from project-related trains along the Reynolds Lead and BNSF Spur and along the BNSF main line in Cowlitz County based on existing freight train speeds. Emissions of PM10 and PM2.5 from project-related trains on the Reynolds Lead and BNSF Spur at 100 feet from the rail lines were projected to be below the NAAQS (Table 6.7-4). The estimated maximum modeled 24-hour increase in PM10 concentration due to coal dust is 0.28 $\mu g/m^3$; the estimated maximum increase in 24-hour PM2.5 due to coal dust is 0.05 $\mu g/m^3$. The estimated annual PM2.5 concentration would increase 0.01 $\mu g/m^3$. Concentrations would decline by approximately 50% at approximately 160 feet from the rail line. The closest residence is approximately 180 feet from the north side of the Reynolds Lead.

[9] All sources of coal dust emissions were included in the modeling.

Figure 6.7-1. Estimated Maximum Monthly Coal Deposition—On-Site Alternative

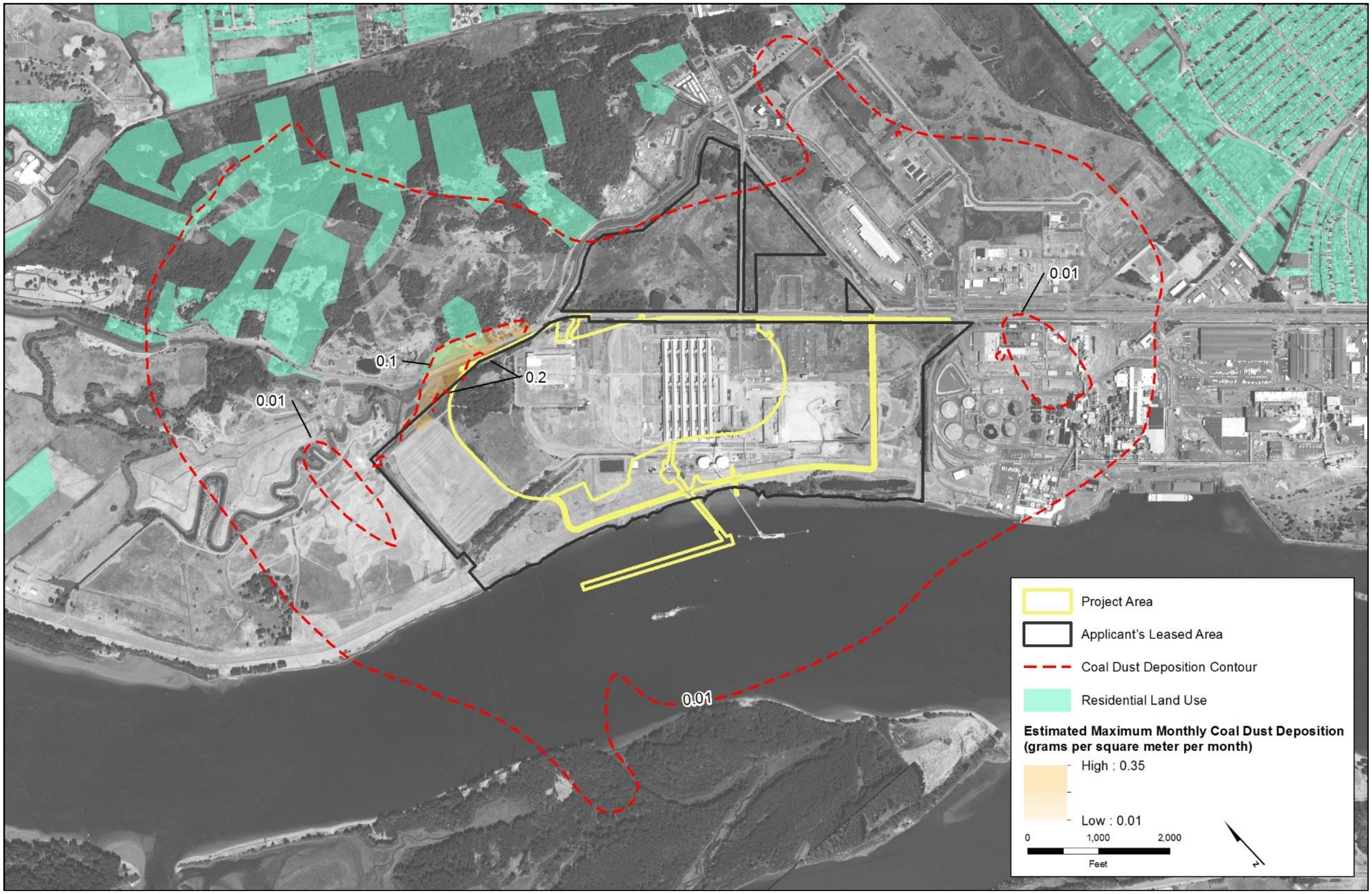


Figure 6.7-2. Estimated Maximum Annual Coal Deposition—On-Site Alternative

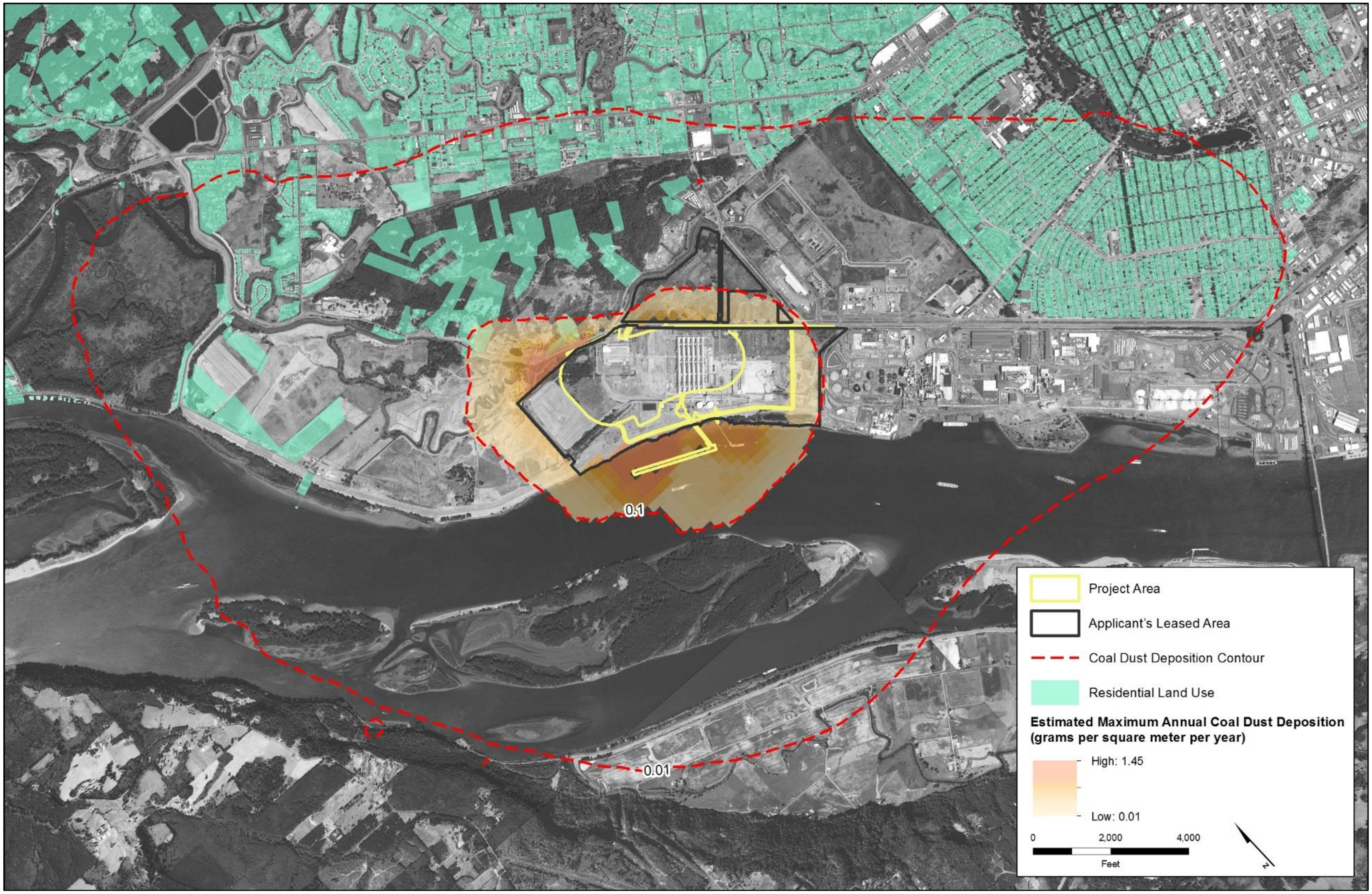


Table 6.7-4. Estimated Maximum PM10 and PM2.5 Concentrations 100 Feet from Rail Line—Reynolds Lead and BNSF Spur for Coal Particles Only

Pollutant	Averaging Period	Maximum Modeled Impact (μg/m³)	Background[a] (μg/m³)	Total Concentration (μg/m³)	NAAQS (μg/m³)
PM10	24 hour[b]	0.28	28.0	28.28	150
PM2.5	24 hour[c]	0.05	16.0	16.05	35
	Annual[d]	0.01	5.3	5.31	12

Notes:
[a] Background concentrations are monitoring design values from Northwest International Air Quality Environmental Science and Technology Consortium (2015).
[b] The PM10 24-hour modeled impact is 3-year average of the second-highest concentrations.
[c] The PM2.5 24-hour modeled impact is the 3-year average of the 98th percentile of the daily maximum concentrations.
[d] Modeled annual impact is the annual average over 3 modeled years.
NAAQS = National Ambient Air Quality Standards; μg/m³ = microns per cubic meter

Table 6.7-5 reports the estimated maximum increase in deposition along the Reynolds Lead and BNSF Spur at the closest residence (approximately 180 feet from the Reynolds Lead). The estimated maximum monthly deposition would be below the benchmark used for the analysis. These concentrations would decrease by 50% at approximately 340 feet from the Reynolds Lead and BNSF Spur.

Table 6.7-5. Estimated Maximum and Average Monthly Coal Dust Deposition—Reynolds Lead and BNSF Spur

Distance (feet)	Average Monthly Deposition (g/m²/month)	Maximum Monthly Deposition (g/m²/month)	Benchmark Used for the Analysis (g/m²/month)[a]
180	0.013	0.017	2.0
340	0.006	0.008	2.0

Notes:
[a] Source: New Zealand Ministry of Environment 2001
g/m²/month = grams per square meter per month

6.7.5.2 Off-Site Alternative

The same approach was used to model coal dust emissions for the proposed export terminal at the Off-Site Alternative location as was used for the On-Site Alternative.

Construction

Construction of the proposed export terminal at the Off-Site Alternative location would not result in direct or indirect impacts related to coal dust because construction would not involve any coal-handling or transport activities.

Operations—Direct Impacts

Operation of the proposed export terminal at the Off-Site Alternative location would result in the following direct impact.

Coal Dust in and near the Project Area

Operation of the terminal would emit coal dust from coal-handling and transport activities in the project area. Table 6.7-6 illustrates the estimated maximum annual monthly and coal dust deposition at the project area boundary.

Table 6.7-6. Estimated Maximum Annual and Monthly Coal Dust Deposition

Location	Maximum Annual Deposition (g/m^2/year)	Maximum Monthly Deposition (g/m^2/month)	Benchmark Used for the Analysis (g/m^2/month)[a]
Project area boundary (fence line) 350 feet southeast of the rail unloading station	1.83	0.38	2.00

Notes:
[a] Source: New Zealand Ministry of Environment 2001
g/m^2/year = grams per square meter per year; g/m^2/month = grams per square meter per month

The estimated maximum monthly coal dust deposition (0.38 g/m^2/month) would occur at the project area boundary east of the terminal (Figure 6.7-3). The estimated maximum monthly coal dust deposition (0.38 g/m^2/month) would be below the benchmark used for the analysis (2.0 g/m^2/month). The spatial extent of the estimated maximum annual coal dust deposition near the project area is shown in Figure 6.7-4. As shown, within a few thousand feet of the project area, the annual deposition of coal dust is estimated to be less than 0.1 g/m^2.

Operations—Indirect Impacts

Operation of the terminal at the Off-Site Alternative location would result in the following indirect impact.

Coal Dust along the Reynolds Lead and BNSF Spur

Under the Off-Site Alternative, PM10 and PM 2.5 concentrations and coal dust deposition would extend along the Reynolds Lead approximately 2,500 feet farther than it would for the On-Site Alternative. The estimated maximum PM10 and PM2.5 concentrations and estimated maximum and average monthly coal dust deposition along the Reynolds Lead and BNSF Spur (Tables 6.7-4 and 6.7-5) would be the same as described for the On-Site Alternative.

6.7.5.3 No-Action Alternative

Under the No-Action Alternative, the Corps would not issue a Department of the Army permit authorizing construction and operation of the proposed export terminal. As a result, impacts resulting from constructing and operating the terminal would not occur. In addition, not constructing the terminal would likely lead to expansion of the adjacent bulk product business onto the export terminal project area. Refer to Section 6.6, *Air Quality*, for the potential air quality impacts under the No-Action Alternative.

Figure 6.7-3. Estimated Maximum Monthly Coal Deposition—Off-Site Alternative

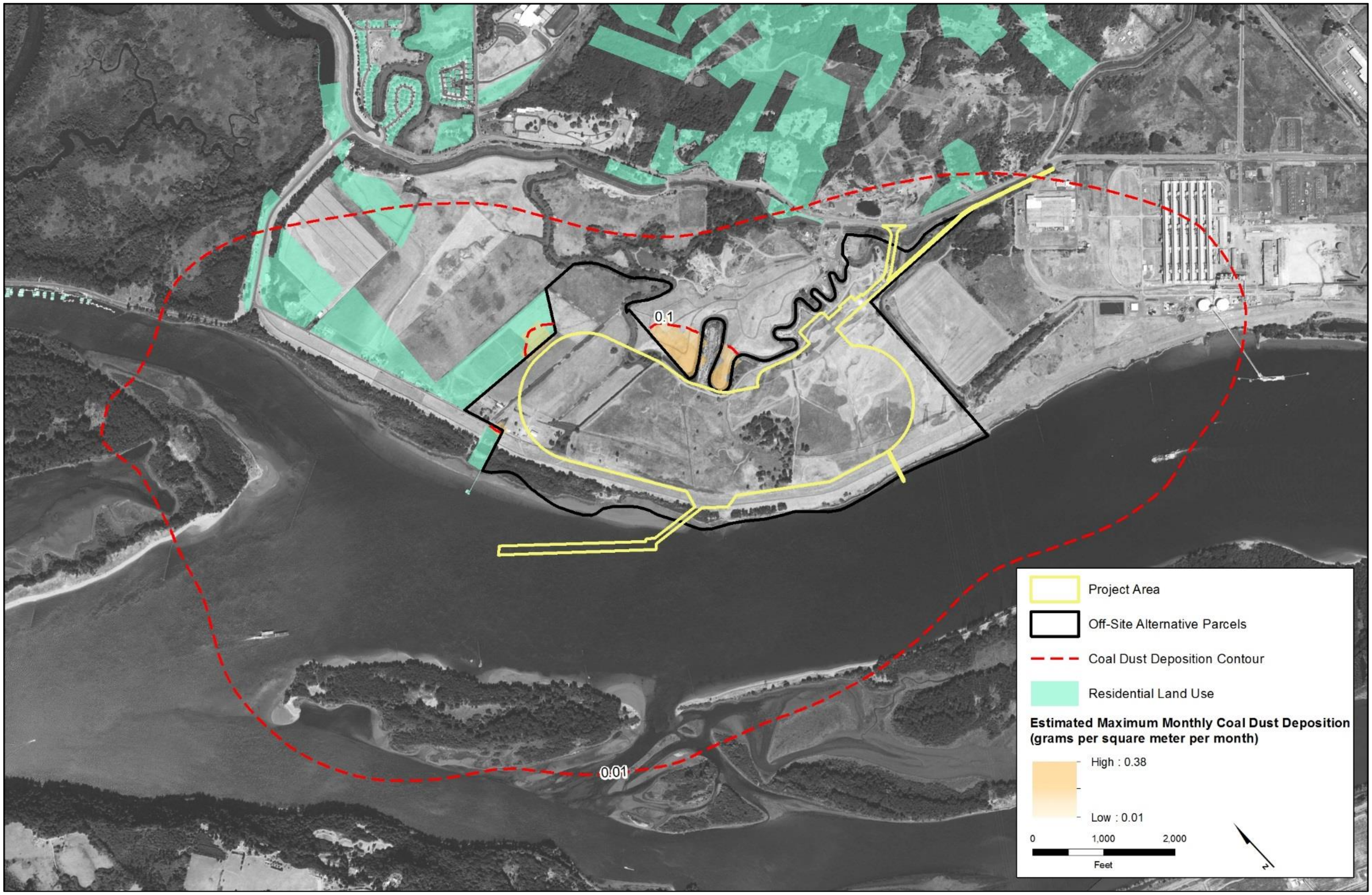
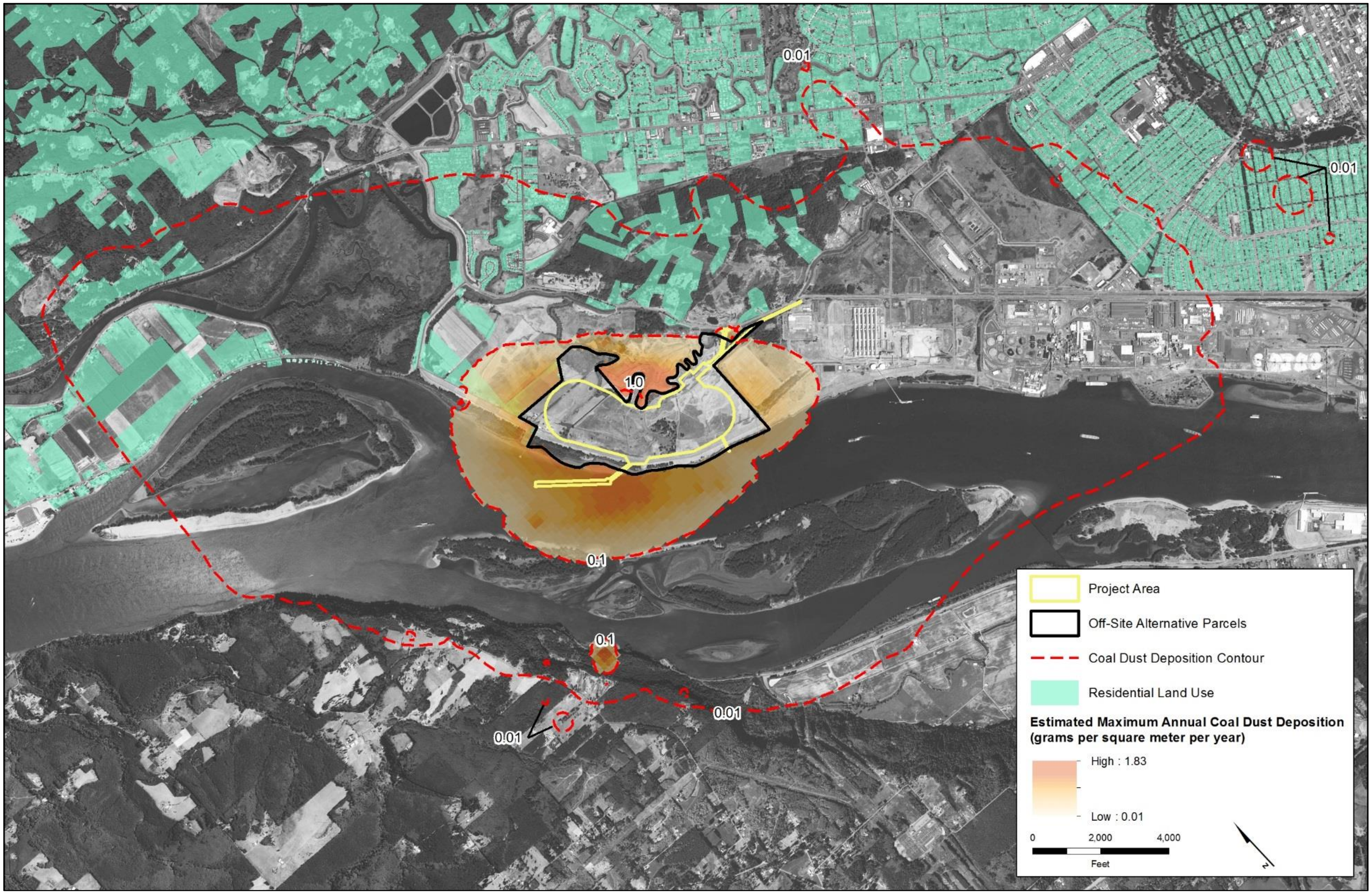


Figure 6.7-4. Estimated Maximum Annual Coal Deposition (Off-Site Alternative)



6.7.6 Required Plans and Permits

There are no permitting requirements relative to coal dust. The following permit would be required relating to air quality (including coal dust) for the proposed export terminal.

- **Notice of Construction—Southwest Clean Air Agency.** Businesses and industries causing or potentially causing air pollution are required to receive approval from the local air agency prior to beginning construction. These requirements of Washington's Clean Air Act apply statewide (Chapter 70.94 Revised Code of Washington [RCW]). Businesses located in Cowlitz County are regulated by the Southwest Clean Air Agency. The agency rules generally require an air permit for a stationary sources emitting more than 0.75 ton per year of PM10 or 0.5 ton per year for PM2.5.[10] It is anticipated these levels would be exceeded and the Applicant would need to file a permit application and receive an approved Notice of Construction air permit prior to constructing, installing, establishing, or modifying any equipment or operations that may emit air pollution.

[10] Other criteria air pollutants have higher emissions thresholds.

6.8 Greenhouse Gas Emissions

Greenhouse gases are air pollutants that trap solar energy in the atmosphere and contribute to global warming and climate change. Greenhouse gases are emitted and removed from the atmosphere by a combination of natural and human (anthropogenic) processes.[1] This section describes the estimated greenhouse gas emissions resulting from construction and operation of the proposed export terminal.

6.8.1 Greenhouse Effect

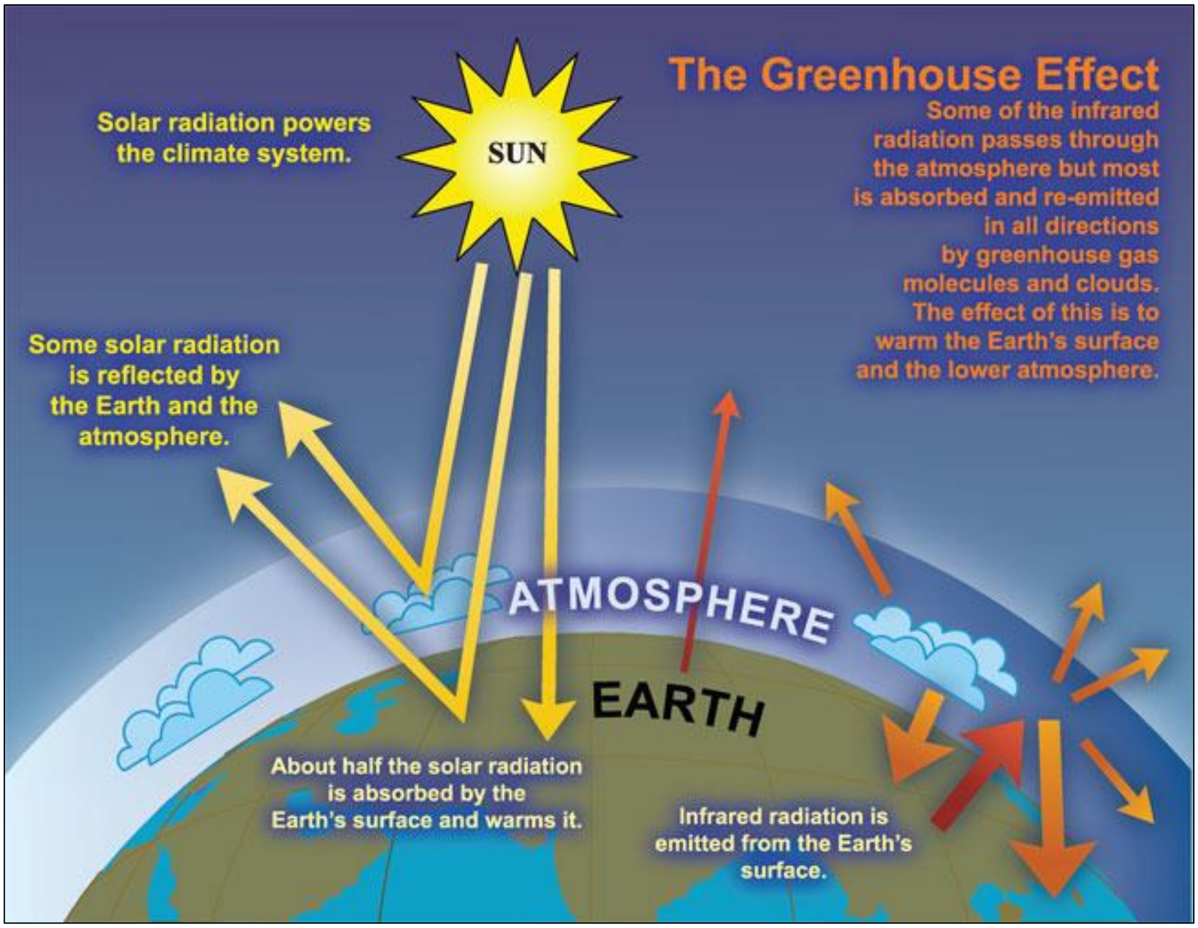
Earth retains outgoing thermal energy and incoming solar energy in the atmosphere, thus maintaining temperature levels suitable for life. This retention of energy by the atmosphere is known as the greenhouse effect.[2] When solar radiation reaches Earth, most of the solar radiation is absorbed by Earth's surface, reflected by Earth's surface and atmosphere, or—to a lesser degree—absorbed by Earth's atmosphere. Factors such as the reflectivity of Earth's surface, the abundance of water vapor, and the extent of cloud cover affect the degree to which solar radiation may be absorbed or reflected. Figure 6.8-1 shows the energy flows to and from Earth and the role the greenhouse effect plays in maintaining heat in the atmosphere.

[1] Examples of natural sources include decomposition of organic matter and aerobic respiration. Anthropogenic greenhouse gas emissions are predominantly from the combustion of fossil fuels, although other sources including industrial processes, land-use change (e.g., deforestation), agriculture, and waste management are also significant sources of greenhouse gases.

[2] The Intergovernmental Panel on Climate Change (2013) defines the greenhouse effect as follows:

> The infrared radiative effect of all infrared-absorbing constituents in the atmosphere. Greenhouse gases, clouds, and (to a small extent) aerosols absorb terrestrial radiation emitted by the Earth's surface and elsewhere in the atmosphere. These substances emit infrared radiation in all directions, but, everything else being equal, the net amount emitted to space is normally less than would have been emitted in the absence of these absorbers because of the decline of temperature with altitude in the troposphere and the consequent weakening of emission. An increase in the concentration of greenhouse gases increases the magnitude of this effect; the difference is sometimes called the enhanced greenhouse effect. The change in a greenhouse gas concentration because of anthropogenic emissions contributes to an instantaneous radiative forcing. Surface temperature and troposphere warm in response to this forcing, gradually restoring the radiative balance at the top of the atmosphere.

Figure 6.8-1. Model of the Natural Greenhouse Effect



Source: Intergovernmental Panel on Climate Change 2007.

The extent to which a given greenhouse gas[3] traps energy in the atmosphere and contributes to the overall greenhouse effect is characterized by its global warming potential (GWP).[4] Some gases are more effective at trapping heat, while others may be longer-lived in the atmosphere. The reference gas against which others are compared is carbon dioxide, and GWP is expressed in terms of carbon dioxide-equivalent (CO_2e). The unit CO_2e represents both a gas's ability to trap heat and the rate at

[3] The Intergovernmental Panel on Climate Change (2013) defines greenhouse gas as follows:

> Greenhouse gases are those gaseous constituents of the atmosphere, both natural and anthropogenic, that absorb and emit radiation at specific wavelengths within the spectrum of terrestrial radiation emitted by the Earth's surface, the atmosphere itself, and by clouds. This property causes the greenhouse effect. Water vapor (H_2O), carbon dioxide (CO_2), nitrous oxide (N_2O), methane (CH_4) and ozone (O_3) are the primary greenhouse gases in the Earth's atmosphere. Moreover, there are a number of entirely human-made greenhouse gases in the atmosphere, such as the halocarbons and other chlorine- and bromine-containing substances, dealt with under the Montreal Protocol. Beside CO_2, N_2O and CH_4, the Kyoto Protocol deals with the greenhouse gases sulphur hexafluoride (SF_6), hydrofluorocarbons (HFCs) and perfluorocarbons (PFCs).

[4] The Intergovernmental Panel on Climate Change (2013) defines Global Warming Potential (GWP) as follows: An index, based on radiative properties of greenhouse gases, measuring the radiative forcing following a pulse emission of a unit mass of a given greenhouse gas in the present-day atmosphere integrated over a chosen time horizon, relative to that of carbon dioxide. The GWP represents the combined effect of the differing times these gases remain in the atmosphere and their relative effectiveness in causing radiative forcing. The Kyoto Protocol is based on GWPs from pulse emissions over a 100-year time frame, and this time frame has remained the standard within the scientific community.

which it breaks down in the atmosphere. Most analyses use 100 years as the period of reference for GWPs, and this analysis conforms to that convention. For example, 1 unit of carbon dioxide has a 100-year GWP of 1, whereas an equivalent amount of methane has a GWP of 25.

Table 6.8-1 presents the 100-year GWPs from the IPCC Fourth Assessment Report for the greenhouse gases included in the study.[5]

Table 6.8-1. Global Warming Potentials

Greenhouse Gas	100-Year Global Warming Potential
Carbon dioxide	1
Methane	25
Nitrous oxide	298

Notes:
Source: Intergovernmental Panel on Climate Change 2007.

The predominant gases in Earth's atmosphere, nitrogen and oxygen (which together account for nearly 90% of the atmosphere), exert little greenhouse effect. Some naturally occurring gases, such as carbon dioxide, methane, and nitrous oxide, trap outgoing energy and contribute to the greenhouse effect. Additionally, manufactured pollutants, such as hydrofluorocarbons,[6] can contribute to the greenhouse effect. Most air pollutants[7] (e.g., sulfur dioxide and particulate matter) are short-lived in the atmosphere and therefore have more of a local or regional impact on air quality and the environment. Most greenhouse gases (e.g., carbon dioxide, methane, nitrous oxide) are long-lived and become globally mixed in the atmosphere, and therefore affect the atmosphere similarly regardless of where they are emitted.[8]

Atmospheric concentrations of greenhouse gases have increased since the Industrial Revolution, but the natural reservoirs of the climate system (e.g., oceans, soils, and forests) that remove certain greenhouse gases (e.g., carbon dioxide, methane, nitrous oxide) from the atmosphere do not have the capacity to store all of the additional emissions. Additionally, concentrations of long-lived, manufactured greenhouse gases —such as hydrofluorocarbons—have increased in recent decades. As the atmospheric concentrations of greenhouse gases increase, the atmosphere's ability to retain heat increases as well. Since reliable instrumental record keeping of temperatures in the U.S. began in 1895, the U.S. average temperature has risen by approximately 1.3 to 1.9 degrees Fahrenheit (°F) (U.S. Global Change Research Program 2014). Furthermore, U.S. average temperatures throughout

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[5] While additional greenhouse gases (HFCs, PFCs, SF_6) were considered for this analysis as per the Council on Environmental Quality (2014) guidance, carbon dioxide, methane, and nitrous oxide are the greenhouse gases emitted from the fossil fuel combustion and the upland and wetland land-cover change activities considered in this study.

[6] Hydrofluorocarbons are any of a class of partly chlorinated and fluorinated hydrocarbons, used as an alternative to chlorofluorocarbons in foam production, refrigeration, and other processes.

[7] Per the U.S. Environmental Protection Agency (EPA) Report on the Environment (ROE) (U.S. Environmental Protection Agency 2016a), air pollutant is defined as

> Any substance in air that could, in high enough concentration, harm human health and the environment and cause property damage. Air pollutants can include almost any natural or artificial composition of matter capable of being airborne—solid particles, liquid droplets, gases, or a combination thereof. Air pollutants are often grouped in categories for ease in classification; some of the categories are sulfur compounds, volatile organic compounds, particulate matter, nitrogen compounds, and radioactive compounds.

[8] Some greenhouse gases like tropospheric ozone have relatively short atmospheric lifetimes and more of a local impact.

the 21st century are expected to increase at a faster pace, by 2.5°F to 11°F above preindustrial levels by 2100 (U.S. Global Change Research Program 2014).

Most of the observed increase in global average temperatures since the mid-20th century is likely due to the observed increase in anthropogenic greenhouse gas concentrations (Intergovernmental Panel on Climate Change 2007). Any local contribution to this observed increase in anthropogenic greenhouse gas concentration in turn contributes to the increase in global average temperature. The impacts of higher global surface temperatures include widespread changes in Earth's climate system. This may affect weather patterns, biodiversity, human health, and infrastructure.

6.8.2 Regulatory Setting

Laws and regulations relevant to greenhouse gases are summarized in Table 6.8-2.

Table 6.8-2. Regulations, Statutes, and Guidelines for Greenhouse Gases

Regulation, Statute, Guideline	Description
Clean Air Act of 1963 (42 USC 7401)	In 2007, the U.S. Supreme Court ruled GHGs are air pollutants under the Clean Air Act. *Massachusetts et al. v. Environmental Protection Agency*, 549 U.S. 497 (2007).[a]
Greenhouse Gas Reporting Program (40 CFR 98)	Owners and operators of certain facilities that directly emit GHG as well as for certain suppliers are subject to mandatory GHG reporting requirements. For suppliers, the GHGs reported are the quantity that would be emitted from combustion or use of the products supplied. In general, facilities emitting 25,000 metric tons or more of GHGs from certain sectors are subject to annual reporting.
The President's Climate Action Plan (2013)	Sets forth plan for cutting carbon pollution, preparing for the impacts of climate change, and leading international efforts to address climate change (Executive Office of the President 2013).
United States Intended Nationally Determined Contribution Submittal to the United Nations Framework Convention on Climate Change	The United States and other nations submitted Intended Nationally Determined Contribution to the United Nations in 2015. The United States intends to achieve an economy-wide target of reducing its greenhouse gas emissions by 26 to 28% below its 2005 level in 2025 and to make best efforts to reduce its emissions by 28% (United Nations Framework Convention on Climate Change n.d.).

Notes:

[a] In 2009, EPA proposed the Endangerment Finding and the Cause or Contribute Findings for Greenhouse Gases under Section 202(a) of the Clean Air Act. The Endangerment Findings determined that the current and projected concentrations for carbon dioxide, methane, nitrous oxide, hydrofluorocarbons, perfluorinated chemicals, and sulfur hexafluoride posed a threat to the health and welfare of current and future generations (U.S. Environmental Protection Agency 2009). This sets the legal foundation for regulating GHG emissions from sources of these six well-known GHGs, such as vehicles, industrial facilities, and power plants.

USC = United States Code; CFR = Code of Federal Regulations; EPA = U.S. Environmental Protection Agency; GHG = greenhouse gas

6.8.3 Study Area

The study areas are the same for both the On-Site Alternative and Off-Site Alternative. The study areas consist of the project areas, those areas in the vicinity of the project that could be affected by greenhouse gases resulting from construction and operation of the proposed export terminal, and the lower Columbia River from the project area to the mouth of the river. These study areas are consistent with the Corps *NEPA Scope of Analysis Memorandum for Record* (MFR) (2014) and adjusted to reflect emissions related to the proposed export terminal.

6.8.4 Methods

This section describes the sources of information and methods used to evaluate the greenhouse gas emissions associated with the construction and operation of the proposed export terminal. The *NEPA Greenhouse Gas Emissions Technical Report* (ICF International 2016a) provides detailed descriptions of the methods summarized below.

6.8.4.1 Information Sources

The following sources of information were used to identify the existing conditions relevant to greenhouse gas emissions in the study areas.

- *NEPA Air Quality Technical Report* (ICF International 2016b)
- *NEPA Energy Technical Report* (ICF International 2016c)
- *NEPA Rail Transportation Technical Report* (ICF International 2016d)
- *NEPA Vessel Transportation Technical Report* (ICF International 2016e)
- *NEPA Vegetation Technical Report* (ICF International 2016f)

To estimate the greenhouse gases emitted as a result of the processes described in the above referenced reports, analysts used those reports' estimates of fuel consumption and vehicle operation (referred to as *activity data*[9]) and combined that data with greenhouse gas emissions factors to estimate greenhouse gas emissions for the proposed export terminal.

The greenhouse gas emissions factors were drawn from the following sources based on representative and reputable U.S. Environmental Protection Agency (EPA), regional, and industry sources.

- California Air Resources Board (2011)
- Clean Cargo Working Group (2014)
- Energy Information Agency (1994)
- U.S. Environmental Protection Agency (1996, 2009, 2014, 2015)

[9] An activity is a practice or ensemble of practices that take place on a delineated area over a given period. *Activity data* are data on the magnitude of a human activity resulting in emissions or removals taking place during a given period of time (e.g., data on energy use, data on equipment used during construction of the proposed export terminal) (Intergovernmental Panel on Climate Change 2006).

6.8.4.2 Impact Analysis

The following methods were used to evaluate the potential impacts of the proposed export terminal on greenhouse gas emissions. This section also describes the method for estimating the greenhouse gas emissions from each emissions source.

Scope of the Analysis

The greenhouse gas emissions analysis considers the following elements.

- **Analysis period.** To be consistent with activity data from the other resources, this analysis considers construction, operation, transportation, and fossil fuel combustion emissions from 2018 through 2038.
- **Emissions in the project area.** Greenhouse gas emissions in the project area are estimated for the construction and operation of the proposed export terminal. These are described in Section 6.8.4, *Methods*. Greenhouse gas emissions are measured in CO_2e, which is based on the global warming potential factors consistent with the Intergovernmental Panel on Climate Change Fourth Assessment Report (2007) for carbon dioxide, methane, and nitrous oxide.[10]

Emissions Outside the Project Area

Greenhouse gas emissions are estimated from the proposed export terminal that are outside the project area but within the study area. These are also described below in *Method for Impact Analysis*. Greenhouse gas emissions calculations are characterized in terms of CO_2e.

Method for Assembling an Emissions Time Series

Because greenhouse gases accumulate in the atmosphere, this assessment characterizes greenhouse gases over the full analysis period (2018 to 2038) for each year, as well as for each alternative. The time series was estimated from the following data.

The activity data characterizing export terminal operations represent conditions in 2028, when the facility is expected to be fully operational. These activity data do not reflect the export terminal startup, in which the coal throughput increases from zero immediately after construction in 2020, to full capacity of 44 million metric tons by 2028. Emissions estimates are proportional to throughput and can be expressed as emissions per unit of coal throughput.

6.8.5 Affected Environment

The affected environment related to greenhouse gas emissions in the study areas is described below.

- **Project area for the On-Site Alternative**. Existing greenhouse gas emissions in the project area are primarily related to the ongoing hazardous waste cleanup activities, emissions generated from electricity consumption for the Applicant's administration building, and emissions from on-site vehicles.

[10] The U.S. Greenhouse Gas Emissions Inventory covers six greenhouse gases; however, since the proposed export terminal does not include refrigeration, hydrofluorocarbons, perfluorocarbons, and sulfur hexafluoride were not included in the estimate of greenhouse gas emissions.

- **Project area for the Off-Site Alternative.** Greenhouse gas emissions in the project area for the Off-Site Alternative are primarily related to the rural residential land uses and small-scale farming.
- **Reynolds Lead and BNSF Spur.** Approximately 7 trains per day each consisting of approximately 78 cars typically pass between the BNSF Spur. Baseline traffic on the Reynolds Lead in the project areas in Cowlitz County is about 2 trains per day.
- **Columbia River.** Greenhouse gas emissions on the Columbia River are primarily related to vessel traffic. The *NEPA Vessel Transportation Technical Report* provides estimates of existing vessel traffic by vessel type.

6.8.5.1 Method for Impact Analysis

This section provides an overview of the method for calculating greenhouse gas emissions in the study areas for each source. More information about each method is described in the *NEPA Greenhouse Gas Emissions Technical Report*.

Sources of Emissions

Greenhouse gas emissions were estimated from construction, operation, and transportation for the following activities related to the proposed export terminal.

- **Upland and wetland land-cover change.** The removal of vegetation, disturbance of surface soil, and infilling of wetlands associated with clearing and grading during construction of the terminal would affect carbon stocks, carbon sequestration, and wetland emissions. Upland and wetland vegetation and soil store and sequester carbon dioxide (remove carbon dioxide from the atmosphere); consequently, their removal would increase greenhouse gas emissions. Wetlands also emit carbon dioxide and methane, consequently, their removal would partially decrease greenhouse gas emissions.
- **Export terminal construction activities.** Construction of the terminal would generate greenhouse gas emissions from operation of construction equipment and transport of employees and construction materials to the project area.
- **Employee commuting.** Construction and operation of the terminal would generate greenhouse gas emissions from construction workers commuting to the project area, and during operations, daily employee commuting to and from the project area.
- **Rail transport.** Operation of the terminal would require rail transport to and from the export terminal on the BNSF Spur and Reynolds Lead, and in the project areas.
- **Export terminal operations.** Operation of the terminal would generate greenhouse gas emissions from equipment such as loaders, maintenance vehicles, and cranes.
- **Vessel idling and tugboat use at the export terminal.** Operation of the terminal would generate greenhouse gas emissions from vessel maneuvering into and then idling at the loading area. Additionally, tugboats assisting in vessel maneuvering would generate greenhouse gas emissions.
- **Vessel transport.** Operation of the terminal would generate greenhouse gas emissions from vessels transporting coal from the project area to the mouth of the Columbia River.

- **Export terminal electricity consumption.** Operation of the terminal would consume electricity, generating greenhouse gas emissions from off-site power plants supplying that electricity.

6.8.6 Impacts

This section describes the greenhouse gas emissions that would result from construction and operation of the proposed export terminal. Detailed emissions by alternative are available in the *NEPA Greenhouse Gas Emissions Technical Report*.

6.8.6.1 On-Site Alternative

This section describes the greenhouse gas emissions that could occur in the study areas as a result of construction and operation of the export terminal at the On-Site Alternative location. Aggregated results of each of the emissions sources described previously is also presented. Details of the emissions associated with each source are available in the *NEPA Greenhouse Gas Emissions Technical Report.*

Construction

Results of the greenhouse gas analysis indicate construction activities would emit 23,598 metric tons of CO_2e (Table 6.8-3). Initial construction was assumed to occur over an 18-month period (2018 to 2020). Consequently, except for vegetation removal, soil disturbance, and wetland loss, the total greenhouse gas construction-related emissions from 2018 to 2020 would be 1.5 times the initial 12-month period (Table 6.8-3). Emissions related to the carbon stock loss associated with vegetation removal, soil disturbance, and wetland loss would all occur in the first year.

Operations

Greenhouse gas emissions from the proposed export terminal operations would be primarily driven by rail transport of coal, vessel idling and tugboat use at the terminal, and vessel transport of coal (Table 6.8-4). The greenhouse gas emissions are presented in terms of the 2028 emissions (the assumed first year of full export capacity operation for the export terminal) and total emissions from 2021 (when export operation begins) to 2038.

Table 6.8-3. Construction Greenhouse Gas Emissions (metric tons of CO_2e)—On-Site Alternative

Source	Greenhouse Gas Emissions (metric tons of CO_2e)
Vegetation Removal, Soil Disturbance, and Wetland Loss[a]	
Emissions During 12 Months of Construction Period	11,771
Total Emissions 2018–2020	11,821
Construction Equipment	
Emissions During 12 Months of Construction Period	5,349
Total Emissions 2018–2020[b]	8,024
Construction Worker Commuting	
Emissions During 12 Months of Construction Period	465
Total Emissions 2018–2020[b]	698
Construction Trucks	
Emissions During 12 Months of Construction Period	1,081
Total Emissions 2018–2020[b]	1,621
Construction Barges	
Emissions During 12 Months of Construction Period	955
Total Emissions 2018–2020[b]	1,433
Subtotal Construction Emissions	
Emissions During 12 Months of Construction Period	19,622
Total Emissions, 2018–2020	23,598

Notes:

[a] Vegetation removal, soil disturbance, and wetland loss emissions represent the total emissions resulting from proposed export terminal emissions sources, including (1) loss of accumulated carbon stocks during construction; (2) lost sequestration from removed vegetation that increases emissions; and (3) reduction in carbon dioxide and methane emissions from permanently filled wetlands.

[b] Construction emissions occur over an 18-month period prior to the operation of the export terminal; therefore, emissions from 2021 through 2038 are zero. Given the 18-month period for construction, total construction emissions are those for the 12-month period multiplied by 1.5.

Table 6.8-4. Terminal Operation Greenhouse Gas Emissions (metric tons of CO_2e)—On-Site Alternative

Source	Greenhouse Gas Emissions (metric tons of CO_2e)
Vegetation Removal, Soil Disturbance, and Wetland Loss[a]	
Annual Emissions, 2028	17
Total Emissions, 2021–2038	300
Export Terminal Equipment Operations	
Annual Emissions, 2028	903
Total Emissions, 2021–2038	12,894
Vessel Idling and Tugboat Use	
Annual Emissions, 2028	7,338
Total Emissions, 2021–2038	104,740
Rail Operation (Project Area)	
Annual Emissions, 2028	1,414
Total Emissions, 2021–2038	20,184
Employee Commuting	
Annual Emissions, 2028	275
Total Emissions, 2021–2038	3,922
Rail Transport (Reynolds Lead and BNSF Spur)	
Annual Emissions, 2028	5,321
Total Emissions, 2021–2038	75,836
Vessel Transport	
Annual Emissions, 2028	47,721
Total Emissions, 2021–2038	682,202
Electricity Consumption	
Annual Emissions, 2028	177
Total Emissions, 2021–2038	3,191
Subtotal Operations Emissions	
Annual Emissions, 2028	63,167
Total Emissions, 2021–2038	903,269

Notes:

[a] Vegetation removal, soil disturbance, and wetland loss emissions represent the total emissions resulting from export terminal emissions sources, adjusted for 1) lost sequestration from removed vegetation that increases emissions; and 2) reduction in carbon dioxide and methane emissions from permanently filled wetlands.

Total Greenhouse Gas Emissions

Table 6.8-5 presents the total combined emissions from construction (beginning in 2018) and operations (from 2021 through 2038).[11]

Table 6.8-5. Total Greenhouse Gas Emissions (metric tons of CO_2e)—On-Site Alternative

Period	Emissions
Project Area Emissions	
Annual Emissions, 2028	9,947
Total Emissions, 2018–2038	165,637
Emissions Generated beyond Project Area[a]	
Annual Emissions, 2028	53,219
Total Emissions, 2018–2038	761,229
Total	
Annual Emissions, 2028	63,167
Total Emissions, 2018–2038	926,866

Notes:

[a] Emissions from electricity consumption are included as emissions beyond the project area. While the consumption of electricity takes place in the project area, the emissions associated with this consumption take place outside the project area.

6.8.6.2 Off-Site Alternative

This section describes the greenhouse gas emissions that could occur in the study areas as a result of construction and operation of the proposed export terminal at the Off-Site Alternative location. This section presents the aggregated results of each of the emissions sources described previously. Details of the emissions associated with each source are available in the *NEPA Greenhouse Gas Emissions Technical Report.*

Construction

Construction of the proposed export terminal at the Off-Site Alternative location would result in greenhouse gas emissions of 47,613 metric tons of CO_2e (Table 6.8-6). Initial construction was assumed to occur over an 18-month period (2018 to 2020). Consequently, except for vegetation removal, soil disturbance, and wetland loss, the total greenhouse gas construction-related emissions from 2018 to 2020 would be 1.5 times the initial 12-month period. Emissions related to the carbon stock loss associated with vegetation removal, soil disturbance, and wetland loss would all occur in the first year.

[11] Although this analysis only looks at emissions over the 21-year time horizon specified in Section 6.8.4.2, *Impact Analysis,* actual emissions from operating the terminal would continue throughout the lifetime of the export terminal.

Table 6.8-6. Construction Greenhouse Gas Emissions (metric tons of CO_2e)—Off-Site Alternative

Source	Greenhouse Gas Emissions (metric tons of CO_2e)
Vegetation Removal, Soil Disturbance, and Wetland Loss[a]	
Emissions During 12 Months of Construction Period	35,908
Total Emissions 2018–2020[b]	35,836
Construction Equipment	
Emissions During 12 Months of Construction Period	5,349
Total Emissions 2018–2020[c]	8,024
Construction Worker Commuting	
Emissions During 12 Months of Construction Period	465
Total Emissions 2018–2020[c]	698
Construction Trucks	
Emissions During 12 Months of Construction Period	1,081
Total Emissions 2018–2020[c]	1,621
Construction Barges	
Emissions During 12 Months of Construction Period	955
Total Emissions 2018–2020[c]	1,433
Subtotal Construction Emissions	
Emissions During 12 Months of Construction Period	43,759
Total Emissions, 2018–2020	47,613

Notes:

[a] Vegetation removal, soil disturbance, and wetland loss emissions represent the total emissions resulting from proposed export terminal emissions sources, including 1) loss of accumulated carbon stocks during construction; 2) lost sequestration from removed vegetation that increases emissions; and 3) reduction in carbon dioxide and methane emissions from permanently filled wetlands.

[b] Emissions are lower compared to the 12-month construction period as a result of a reduction in carbon dioxide and methane emissions from permanently filled wetlands.

[c] Construction emissions occur over an 18-month period prior to the operation of the terminal; therefore, emissions from 2021 through 2038 are zero. Given the 18-month period for construction, total construction emissions are those for the 12-month period multiplied by 1.5.

Operations

Operation of the proposed export terminal at the Off-Site Alternative location would result in annual greenhouse gas emissions of 62,414 metric tons of CO_2e in 2028.

Greenhouse gas emissions during operations would be primarily driven by rail transport of coal, vessel idling and tugboat use at the terminal and vessel transport of coal (Table 6.8-7). The greenhouse gas emissions are presented in terms of the 2028 emissions (the assumed first year of full export capacity) and total emissions from 2021 (when export operations begin) to 2038.

Table 6.8-7. Terminal Operation Greenhouse Gas Emissions (metric tons of CO_2e)—Off-Site Alternative

Source	Greenhouse Gas Emissions (metric tons of CO_2e)
Vegetation Removal, Soil Disturbance, and Wetland Loss	
Annual Emissions, 2028[a]	–24
Total Emissions, 2021–2038[a]	–430
Export Terminal Equipment Operations	
Annual Emissions, 2028	903
Total Emissions, 2021–2038	12,894
Vessel Idling and Tugboat Use	
Annual Emissions, 2028	7,338
Total Emissions, 2021–2038	104,740
Rail Operations (Project Area)	
Annual Emissions, 2028	1,414
Total Emissions, 2021–2038	20,184
Employee Commuting	
Annual Emissions, 2028	275
Total Emissions, 2021–2038	3,922
Rail Transport (Reynolds Lead and BNSF Spur)	
Annual Emissions, 2028	5,695
Total Emissions, 2021–2038	81,177
Vessel Transport	
Annual Emissions, 2028	46,634
Total Emissions, 2021–2038	666,540
Electricity Consumption	
Annual Emissions, 2028	177
Total Emissions, 2021–2038	3,191
Subtotal Operations Emissions	
Annual Emissions, 2028	62,414
Total Emissions, 2021–2038	892,218

Notes:

[a] Emissions are negative as a result of a reduction in carbon dioxide and methane emissions from permanently filled wetlands.

Total Greenhouse Gas Emissions

Table 6.8-8 presents the total combined emissions from construction (beginning in 2018) and operation (from 2021 through 2038).

Table 6.8-8. Total Greenhouse Gas Emissions (metric tons of CO_2e)—Off-Site Alternative

Period	Emissions
Project Area Emissions	
Annual Emissions, 2028	9,907
Total Emissions, 2018–2038	188,922
Emissions Generated Beyond Project Area[a]	
Annual Emissions, 2028	52,507
Total Emissions, 2018–2038	750,908
Total	
Annual Emissions, 2028	62,414
Total Emissions, 2018–2038	939,830

Notes:

[a] Emissions from electricity consumption are included as emissions beyond the project area. While the consumption of electricity takes place in the project area, the emissions associated with this consumption take place outside the project area.

6.8.6.3 Emissions in Context

To provide a frame of reference for the emissions estimates, the projected annual greenhouse gas emissions from the proposed export terminal at the On-Site Alternative and Off-Site Alternative locations are compared to the following emissions sources and targets.

- **Equivalent additional passenger cars added to the road**. This comparison is made to put emissions in context to a common metric.
- **The Washington State GHG target under EPA's Clean Power Plan**. While the emissions sources included in this analysis fall outside the scope of emissions covered under the Clean Power Plan, a comparison was made to the Clean Power Plan to provide context for emissions from the proposed export terminal.
- **The Washington State statewide GHG reduction target, and projected statewide emissions**. Comparing emissions to statewide projected emissions puts the proposed export terminal in a broader context and compares emissions of the terminal to all emissions sources in Washington State.
- **The U.S. Intended Nationally Determined Contribution target**. Compares emissions to a national target.

The total emissions associated with the On-Site Alternative would be 926,866 metric tons of CO_2e from 2018 to 2038, while total emissions for the Off-Site Alternative during this time would be 939,830 metric tons of CO_2e. The additional emissions from the Off-Site Alternative are primarily due to a greater amount of vegetation removal, soil disturbance, and wetland loss. Annual emissions would be nearly identical for both alternatives when the terminal reaches full export capacity in 2028. Total emissions of the On-Site Alternative would reach 63,167 metric tons of CO_2e in 2028, equivalent to 13,343 additional passenger cars on the road (U.S. Environmental Protection Agency 2016b).

In 2015, EPA finalized state-specific targets to reduce carbon dioxide emissions in the power sector to 32% below 2005 levels by 2030. The statewide mass-based carbon dioxide performance goal for Washington State is approximately 10.74 million short tons (9.74 million metric tons) (U.S.

Environmental Protection Agency 2016b). The 2028 total emissions for either alternative would be approximately 0.6% of that total.

Revised Code of Washington (RCW) 70.235.020, Limiting Greenhouse Gas Emissions, requires annual greenhouse gas emissions to be reduced to 1990 levels (88.4 million metric tons of CO_2e) by 2020, and 25% below 1990 levels by 2035 (66.3 million metric tons of CO_2e). Washington State goals for 2020 and 2035 represent a reduction of 3.3 million metric tons of CO_2e and 25.4 million metric tons of CO_2e, respectively, below the 2011 state emissions levels (91.7 million metric tons of CO_2e). Annual greenhouse gas emissions associated with the proposed export terminal under both the On-Site Alternative and Off-Site Alternative would total approximately 0.06 million metric tons of CO_2e, or about 2% and 0.2% of the 2020 and 2035 emissions reduction goals, respectively. Emissions from the proposed export terminal would represent approximately 0.1% of projected statewide emissions in Washington in 2035 (114.2 million metric tons of CO_2e) (Washington State Department of Ecology 2010).

Included in the U.S. Intended Nationally Determined Contribution, the United States has set an emissions reduction target to reduce emissions by 26 to 28% below 2005 emissions (6,680 million metric tons of CO_2e) by 2025 (United Nations Framework Convention on Climate Change n.d.; U.S. Environmental Protection Agency 2016). This policy would, therefore, reduce annual emissions to a level of 4,943 to 4,810 million metric tons of CO_2e by 2025. This level of emissions in 2025 is 1,165 to 1,298 million metric tons of CO_2e below 2014 annual emissions of 6,108 million metric tons of CO_2e (U.S. Environmental Protection Agency 2016). Greenhouse gas emissions associated with the proposed export terminal would be equivalent to 0.005% of this target range of reductions. If the targets were reached through consistent annual reductions, the United States would have to reduce annual emissions by 106 to 118 million metric tons of CO_2e each consecutive year, beginning in 2015.

6.8.6.4 No-Action Alternative

Under the No-Action Alternative, the Corps would not issue a Department of the Army permit authorizing construction and operation of the proposed export terminal. As a result, impacts resulting from constructing and operating the export terminal would not occur. In addition, not constructing the export terminal would likely lead to expansion of the adjacent bulk product business onto the On-Site Alternative project area. A limited-scale future expansion scenario proposed by the Applicant was evaluated, as described in Chapter 3, *Alternatives*. Under this scenario, uses could result in an estimated annual increase of 1,242 metric tons of CO_2e relative to current conditions in Cowlitz County for locomotive combustion, vessel combustion, and truck transport (Table 6.8-9).

Table 6.8-9. No-Action Alternative Maximum Annual Average Emissions in Cowlitz County

Source	Maximum Annual Average Emissions (metric tons of CO_2e)
Locomotive Combustion	593
Vessel Combustion	411
Haul Trucks	238
Total	1,242

6.8.7 Required Permits

No permits related to greenhouse gas emissions would be required for the proposed export terminal.